

E1 -210	E1 -215	E1 -220	E1 -225	E1 -230
E1 -211	E1 -216	E1 -221	E1 -226	
E1 -212	E1 -217	E1 -222	E1 -227	
E1 -213	E1 -218	E1 -223	E1 -228	
E1 -214	E1 -219	E1 -224	E1 -229	

E1 -210

A mathematical model to forecast surface winds over Sri Lanka

The wind field plays a major role in weather over Sri Lanka. Topography of the island modifies these wind flows both in direction and speed, to produce effects on different scales. This feature is observed to be dominant during the inter-monsoon periods (spells between Southwest and Northeast monsoon periods) where the prevailing wind tends to be calm and having no definite direction.

The surface wind model (SWM) is a single-level primitive equation model, in terrain following the sigma (σ) coordinate system that predicts the winds at the anemometer level. Physical processes are incorporated and suitably parameterized in order to render the model more accurate. The SWM is calibrated against observed data (hourly wind data at selected locations) taken during the inter monsoon periods in the years 1999 and 2000. The SWM has potential to be used as a forecasting tool in day-to-day weather forecasting.

The SWM is applied to Sri Lanka area (79° E to 83° E and 5° N to 11° N) to simulate surface winds at the anemometer level during the inter-monsoon periods. The SWM well simulates thermally driven meso-scale circulations such as Sea Breeze, Land Beeze, Anabatic (upslope) and katabatic (downslope) winds. During the warm afternoon, maximum wind speed of the sea breeze front is reported to be about 7 ms^{-1} (~ 14 Kts) near the shoreline. Penetration of the sea breeze is about 35 Km from the shoreline to wards the is about 35 km from the shoreline towards the land. A weak Anabatic wind flow is seen around the central hills of the island. The results land. A weak Anabatic wind flow is seen around the central hills of the island. The results conform well to the real observations. Nocturnal winds are comparatively a little stronger than the real situation. This effect has already been minimized during the model calibration.

E1 211

A study of the variation of upper atmospheric climatic parameters during SW monsoon along the vertical axis (pressure levels) and their relationship with inland rainfall

The approach of the study consists of an analysis of upper atmospheric parameters during the monsoon seasons. It was carried out through graphical presentations of those parameters along the pressure levels from 850 to 100 hPa levels. Then

correlation analysis was carried out to find speed, air temperature and dew-point temperature of each pressure level during the southwest monsoon period. Katugastota and Kobonella stations are situated on western and eastern slope of the Knuckles Range. For this study, data available at the Department of Meteorology (1968, 71, 74, 1981-86) was used and data along the profile namely AA₁ parallel to NE-SW direction via Colombo and Katugastota was analyzed.

The development of a series of relationships between the monthly rainfalls at selected stations along the Colombo - Katugastota profile (AA₁) with location specific data and upper atmospheric data of Colombo was the ultimate objective. Some of the findings of the study are given below:

1) The analysis of radar wind data in Colombo shows the highest correlation coefficient for wind speed of the 300 hPa pressure level with the rainfall at Katugastota and Kobonella during southwest monsoon. 2) NO significant relationship between air temperature and rainfall for any pressure level during southwest monsoon. 3) Among the pressure levels, dew-point temperature of the 500 hPa level shows a high correlation with the rainfall during the southwest monsoon. Hence, this is a more influential level for rainfall at Katugastota as well as at Kobonella.

E1 212

Influence of easterly waves on January 2001 rainfall in Sri Lanka

It has been noticed that significant rain or thunder showers experiences in any places over the island for consecutive 3-4 days during Northeast monsoon season under the influence of the waves in the easterlies. Analysis of data of a 34-years period has shown that the easterly waves causing widespread rain in Sri Lanka have periodic time about 7 days.

Total rainfall recorded at most of the meteorological stations during January 2001 exceeded the normal and a greater percentage of rainfalls have experienced in a number of 3-4 day spells during 8-12, 17-19, 21-2 and 19-31 in that month. When the local vertical wind profiles were analyzed it was found that a number of easterly waves have passed over Sri Lanka during January 2001.

It was seen that; a. Waves in the easterlies have caused the excess rainfall in January 2001 over many places in Sri Lanka. b. The periodic times of the waves in the easterlies in January 2001 are 3-5 days, 5-7 days, 6-8 days and 3-7 days in altitudes 2.5, 3.0, 4.5, and 6.0 km respectively. C. The periodic times of the easterly waves found in the early study can be confirmed.

E1 213

Surface chlorophyll-a of waters surrounding Sri Lanka as seen from sea WiFS

Ocean colour data obtained from Sea-viewing Wide Field-of-view Sensor (SeaWiFS) through NASA's Goddard DAAC Center are processed and analyzed. Materials such as phytoplankton, suspended sediments and dissolved organic matter affect ocean colour. In this paper distribution of pigment chlorophyll-a (in phytoplankton) in surface waters around Sri Lanka are analyzed. An ocean colour sensor records upward radiance from the sea surface after modification by intervening atmospheric path. Empirical relations have been established that link changes in radiance with changes in chlorophyll-a concentration in sea. Raw data of 1 Km resolution within the area of latitudes 2N-13.5N and longitudes between 76.5E-88.0E on relatively cloud free days during the year 1999 are processed to produce chlorophyll maps. Processed data include about 90 single day maps and composite maps were made for each month and season. The month of June is omitted due to insufficient data.

The seasons are defined approximately as follows: First Inter-monsoon (March-May), Southwest (SW) monsoon (June- September), Second Inter-monsoon (October-November) and Northeast (NE monsoon (December-February). During SW monsoon waters off west and southwest coasts show upwelling regions and exhibit higher surface pigment concentrations ($> 1 \text{ mg M}^{-3}$). This region exhibits a shallow mixed layer (only about 30 M deep) during SW monsoon which supports possible upwelling in the region. During SW monsoon currents originate from the Arabian Sea, where strong upwelling waters to wards south. This enhances surface pigment concentrations as well. During NE monsoon and First Inter-monsoon, waters around Sri Lanka show relatively low chlorophyll-a concentrations ($<0.5 \text{ mg m}^{-3}$) except few upwelling areas off northeast coast. Further research is underway to study correlation between chlorophyll and other relevant atmospheric and oceanographic parameters and also to study criteria to identify possible fishing grounds using chlorophyll maps.

E1 214

Some characteristics of cloud to ground lightning obtained with lightning direction finding systems in Sri Lanka

Some characteristics of lightning ground flashes observed in Sri Lanka by two lightning direction finding (DF) systems are presented in this paper. The average number of strokes per flash observed in this study was 2.85. The average duration between successive strokes (inter-stroke duration) varied from 7 ms to 1.02 s with an average of 123 ms. The cases with long inter-stroke duration could be a result of misidentification of other ground flashes in close proximity as subsequent return strokes by the DF system. The most frequent inter stroke duration was between 40 and 60 ms. The ratio of first return stroke amplitude to that of subsequent return strokes showed larger amplitude than the first return stroke. The observed mean first return stroke current normalized to 100 km is 36 kA, while that of subsequent return strokes is 21 kA. The maximum first return stroke current normalized to 100 km observed in this study was 290 kA while the observed maximum subsequent

return strokes normalized to 100km observed in this study were 23kA, 21 KA, 21 kA, 20 kA, 20 kA, and 16 kA respectively.

E1 215

A simulation study on the correction of site errors in a network of magnetic direction finding station

It is well known that angular measurements by crossed loop antennas, which are widely used to locate lightning cloud to ground flashes are subject to a systematic error know as the site error. Site errors are caused by external objects in the vicinity of the antennas that absorb and reradiate the incoming lightning strike can deviate substantially from the real strike location.

A simulation study was carried out to develop a relatively simple iterative technique to correct the site errors that are present in a network of DF stations. The accuracy of the site error correction depends on the exact placement of the DF stations, the number of stations used, and the shape and magnitude of the site error itself. When a simple double sine curve was used for the site error at one station in a three-station network, the algorithm was able to achieve an accuracy within 1°. When a fourth station was added the accuracy increased sharply bringing it closer to the inherent instrumental accuracy of the system ($\pm 0.5^\circ$). When site errors are added to all the stations in the network, the accuracy decreased notably. The simulation work indicates that the developed technique can be used to correct the site error with a reasonable accuracy comprising of several DF stations. The developed algorithm does not know in prior the shape of the site error curve. Thus, this method can be applied to real data to reduce the site errors in the DF networks to improve the strike position reconstruction.

E1 216

A novel iodide iron conducting polymer electrolyte based on polyacrylonitrille (PAN)

Polyacrylonitrile (PAN) based “gel” electrolytes incorporating plastizicers belong to an interesting class of materials in the field of polymer electrolytes. Although a number of Lithium ion conducting polymer electrolytes based on PAN have been investigated, not much work has been reported on PAN based systems containing other ions, especially anions. In this work the ionic conductivity of PAN based electrolytes with plastizicers Ethylenecarbonate (EC), Propylencecarbonate (PC) and incorporating the salt Tetrapropylammonium Iodide ($\text{Pr}_4\text{N}^+\text{I}^-$), has been studied. The measured ionic conductivities are of the order of $10^{-3} \text{ S cm}^{-1}$ at room temperature.

PAN, EC, PC and Pr₄N⁺I, all with purity 98% (Aldrich) were used in moisture free dry conditions. Various compositions of constituents were used to prepare the electrolyte samples. The complex impedance measurements have been carried out in order to investigate the electrical properties in the frequency range from 20 Hz to 10 MHz by using the Schlumberger SI1260 impedance-gain phase analyzer. The dc polarization technique was used to establish the ionic nature of the electrolyte.

The highest room temperature conductivity of $1.0 \times 10^{-3} \text{ S cm}^{-1}$ was observed for the composition, PAN (18%): EC (36%): PC (36%): Pr₄N⁺I⁻ (10%), by weight ratio. This is an impressive conductivity value, especially promising for room temperature applications of solid polymer electrolytes. The temperature dependence of the ionic conductivity follows a VTF shape.

E1 217

Characteristics of L.B films of c₁₈- Merocyanine - c₁₈ prepared under biasing

(π - A) isotherm were measured for c₁₈ - Rhodamine - and their 1:1 molar mixture. This isotherm showed that Rhodamine - molecules interlock between two chains of - Merocyanine - dye molecules. Absorption spectra of - Merocyanine consist of two peaks, higher-energy absorption peak and positive biasing condition increases lower-energy absorption peak. In addition, in negative biasing condition formation of polymers are higher than formation of monomers and in positive biasing condition formation of monomers are higher than formation of polymers. AF.M images showed that the surfaces of deposited films are extremely flat.

E1 218

Enhancement of electrical conduction of WO₃ incorporated TiO₂ due to sintering

It is well known that the incorporation of higher valence (>4) cations into the crystal structure of TiO₂ improves the electrical conduction properties is studied and further enhancement of electrical conduction due to sintering is discovered.

TiO₂ (rutile structure) was doped using WO₃ (6% by weight) as the dopant precursor and by

The method of high temperature (900 ° C) diffusion. Doped samples were compressed (~ 400 atm) between carbon electrodes to make pellets and the pellets were sintered overnight at different temperatures (from 110° C- 350 ° C) in a vacuum. The variation of electrical conductivity of each sample with temperature was studied.

The conductivity depends significantly on the sintered temperature. The highest conductivity was observed when the sintered temperature was the lowest. The conductivity of the doped sample sintered at 130 ° C ($7 \times 10^{-4} \Omega^{-1} \text{cm}^{-1}$) was about four

orders of magnitude higher than that of sintered at 350 ° C which was about two orders higher than the undoped sample. For a sample sintered at a given temperature, conductivity varies according to an Arrhenius type relation for temperatures below the sintered temperature. Similar features, with lower conductivities, were observed when the samples were sintered in air. Activation energy varies significantly with the sintering temperature. The lowest (0.41 eV) and the highest (1.05 eV) activation energies were obtained when the samples were heated overnight at 130 ° C and 350 ° C, respectively.

E1 219

A method to obtain correct radiation spectra using a non-linear detector

The correct emission spectrum of a radiation source is very important in the construction of photometric instruments. This article presents a method to obtain correct spectra of radiation sources using a spectrum monitoring device which consists of a monochromator, a photo-multiplier tube (PMT) and an X-Y chart recorder.

For convenience, the emission spectra of radiation sources used in colorimeters (Tungsten filament bulbs and LEDs) are discussed to explain this method. To obtain the spectrum, the selected radiation source is fixed at the entrance of the monochromator which consists of a reflective grating. The PMT scans the spectrum and amplifies it to record on a X-Y chart recorder.

Using the above method, the spectrum of a tungsten filament bulb and different coloured LEDs were recorded. Because of the non-linearity of the reflectance coefficient of the grating $-G(\lambda)$ and the cathode response of the PMT $-P(\lambda)$, the monitoring device records the intensity of the radiation improperly.

The reflectance coefficient of the grating $-G(\lambda)$ and the cathode response of the PMT $-P(\lambda)$, in the wavelength range 310 nm - 700 nm were tabulated using their curves provided by the manufacturer. Multiplying these for factors $-G(\lambda) \times P(\lambda)$ each wavelength was prepared. For convenience, the resultant response curve was considered as a polygon and linear equations for each straight line were derived. Using these equations, the resultant spectral response (f) to obtain the corrected radiation spectra. By applying the correction method it was possible to obtain the exact spectra of radiation sources.

E1 220

Estimating the thermoluminescence dates of an ancient terracotta site at Rajanganaya

Terracotta and pottery samples collected from an ancient site at Rajanganaya were dated by Thermoluminescence (TL). In TL, age is estimated from the ratio of accumulated dose/ exposed dose. The accumulated dose is determined by TL. The natural radioactivity of these artifacts and their surrounding sediments was measured using *in-situ* and laboratory gamma spectrometry. The comparison of ^{238}U (deduced from ^{234}Th gamma emission) and that of ^{226}Ra (deduced from ^{214}Pb and ^{214}Bi gamma emissions in equilibrium with ^{222}Ra) shows a significant disequilibrium of the U series. The activity ratio $^{238}\text{U} / ^{226}\text{Ra}$ which is greater than unity in the present study is interpreted as a result of either uranium enrichment or radium impoverishment which had been occurred before the burial of the objects. Taking into account this U-series disequilibrium and assuming this as a recent or permanent effect TL dates were calculated.

TL age estimates obtained for pottery and terracotta are 1292 ± 73 , 1257 ± 59 A.D respectively and are consistent with the uncalibrated radiocarbon dates obtained from Beta Analytical Inc. Florida, USA for charcoal collected at the same location which are $1215 \pm 1135 \pm 105$ and 1175 ± 105 A.D. Except for the TL age estimate 666 ± 116 A.D obtained for a terracotta sample which indicate an older age to this cultural phase. Finally, OxCal Program was used to plot the TL and Calibrated radiocarbon dates where good agreement was obtained.

Therefore, the use of gamma spectrometry and the necessary corrections due to disequilibrium of the U-series allowed the estimation of the TL ages without underestimation. The final results of this study- 6th to 13th century A.D are of fundamental interest to understanding the terracotta culture in Sri Lanka.

E1 221

An intelligent medical information system for the general public and the experts

The use of Information Technology for the purpose of educating the general public in context of health is very limited in Sri Lanka, especially in the rural areas. This can easily be achieved by using modern Information Technology together with the Internet.

This project addresses the above problem by developing a Medical Information System which can be used by the General Public and can be updated by the Medical Experts. The system will be developed as a web server making it possible for the Experts to update information over the Internet from any part of the world. Since not that many people, especially in rural areas in Sri Lanka have access to computers and the Internet, the system allows them to get connected to the system using any telephone connection, be it land or mobile. They can simply dial in to the system and are vocally guided to select any of the diseases that are available, which they need information on. They are provided with information on current diseases, contact information on. They are provided with information on current diseases, contact information of specialists and contact information of medical institutions according to their requirements.

The expert system consists of modules such as the DTMF converter, Text-to voice converter, Heuristic module, Control module and an Authentication module. The telephone interface has been implemented using Visual Basic version 6 together with TAPI version 4 and using a TAPI supported voice modem that provides hardware support to obtain the DTMF tones. The vocal menus and the text to voice converter used have been implemented using Microsoft SAPI version 4. The Web interface was developed using Active Server Pages (ASP) for server side scripting. The system has been tested incrementally including evaluations from medical personnel and is ready for actual use.

E1 222

Agent Based Internet Traffic Control System

In addressing the problem of heavy traffic on the Internet, approaches such as increase of bandwidth, adding high-speed powerful Switches and Routers are not cost effective. Further, the solution using modern protocol such as RIP, BGP, and IGRP etc. also addresses the same issue mainly by concerning limited aspects of hop counts. Despite Genetic Algorithms has shown its potential to give optimal solutions adaptively within dynamically changing situation such as network traffic, it has not been exploited within for networking traffic management sufficiently. Since traffic, it has not been exploited for networking traffic management sufficiently. Since traffic has no pre-determined pattern, the classical statistical approaches also fail. This paper describes an approach using Genetic Algorithms for traffic handling by going beyond hop counts and manipulation of routing table for traffic level.

The agent has been developed to from two agents namely; router agent and manger agent, which operates separately from the kernel of the Router. Each Router has its own router agent who does the traffic controlling while manager agent operates in one portion of the network by communicating with his router agents. Each chromosome is having three genes namely; a route identifier, traffic level of that route and its distance. Upon receiving a stream of packets to a Router, the router agent uses Genetic Algorithm technique to find an optimal will be added to the routing table and the packet stream will be transmitted. The manager agent communicates with his router agents periodically and maintains traffic information about his part of the network. The Agent has been tested using the method of simulation, which is the practical way to evaluate the system. The evaluation was carried out using a questionnaire referring to the problem addressed, approach taken, implemented prototype and lastly the overall project. It was found that the success rate is over 75% through the evaluation carried out with the support of several network administrators.

E1 223

Development of low cost network based virtual instruments

With the rapid expansion in IT, especially in the communication and networking areas, new products and instruments are being introduced into the market frequently. These instruments help researchers to explore their problems in ways that were available a few years ago. Today, many researchers require automated setups that can collect data without their presence. Often large amounts of data required to overcome the noise and other interference on the signals that they study.

A simple DAQ system was developed with most of the general options available in the commercial DAQ systems. This device is composed of several sub units, all of which can be controlled via software written exclusively for the device. The device contains a two channel 8-bit ADC, a two channel 8-bit DAC, a reference voltage selector which is common to both DAC and ADC, an 8-bit digital output, an 8-bit digital input, one 8-bit register and an 8 step digital gain controller for the analog inputs. All inputs are protected from over voltage up to 50 V. the ADC has a sampling speed of 600 ksp/s and hence the device can be operated at the speed of the parallel port (around 800 ksp/s max). The control software for the device was written in Delphi and Assembler languages. The control software allows the device to be operated over the Internet or Intranet (Local Area Network) where the TCP/IP network protocol is used.

E1 224

Development of fuzzy logic based traffic control systems

In Sri Lanka, due to the rapid increase in the number of vehicles being imported, especially during the recent years, and also due to not having the proper road infrastructure to accommodate these vehicles, vehicular traffic has become a major problem for many commuters. To add to this, most traffic control systems use fixed times that do not accommodate the changes in the traffic patterns. Even the advanced systems developed in the recent years (except for systems based on video cameras) are too rigid since pre-determined data cannot recognize the ever-changing traffic patterns on the road.

A system was built based on an OOPIC micro controller. It was assumed that the sensors are already installed and that they provide data pertaining to vehicular traffic at a junction. A feedback mechanism based on the ratio of vehicles in a lane with those present in other lanes was used as the primary criteria to update the traffic signal timing. The feedback mechanism calls a fuzzy-neural sub-system to make the final decision. The sub system makes decisions with the data it receives and also with data previously obtained, and changes the time allocated to each lane. The sub-system 'learns' continuously the most acceptable time allocation for each lane at any given time.

The pilot tests carried out indicate that the system efficiency improves with time as it continues to learn from experience. The sub system also prevented a total breakdown of the traffic control system which may happen due to a faulty sensor in the feedback system.

E1 225

Applying intelligent technique to railway scheduling

Rail transportation is faced with criticism due to it's attributed to not having a proper scheduling system in place. Although developed countries use state-of-the-art technology solutions for railway scheduling, most third world countries, including Sri Lanka still perform railway scheduling manually. This project proposes an automated solution to railway scheduling using Genetic Algorithms.

For railway scheduling, alternate methods of optimization are to use the experience of the dispatchers in creating schedules, or to use a conventional database approach, which consists of past schedules from which queries could be made to determine the optimal schedules from the available schedules. Due to the non-algorithmic nature of railway scheduling, the use of an Artificial Intelligent technique such as Genetic Algorithms provides the best method of optimisation.

The problem domain considered is a single, one-way track linking two major stations, with several intermediate stations in between. The number of trains available for allocation and the commuter demand for each route is determined prior to making the schedule. Based on the commuter demand, the number of trains for each route is allocated. The system has been developed to model a schedule for a given day as a chromosome consisting of the schedule for all the trains allocated for the day. The chromosome consists of five genes representing the Departure Time, Arrival Time, Speed of Train, headway (time-distance between two consecutive trains) and the TRai Type. Once the Chromosome structure has been constructed, the full life cycle of Genetic Algorithms is applied until the optimal schedule is generated. The output is the schedule, including passing times of intermediate stations. The system output can be made available to the Dispatchers and also on the web for commuter information inquiries. The system has been developed using Microsoft Visual Basic and implemented for use on a Microsoft windows 98/NT platform.

E1 226

A heuristic - based approach to effective exploring of large knowledge bases

Exploring of expert systems with large Knowledge Base (KB) are very time consuming and inefficient. Human experts have some heuristics about the selection

of rules for answering questions. This feature has not been exploited as a feature of expert systems to date. Expert system technology has researched into various techniques in conflict resolution. The issue of need for exploring large KBs for answering questions has not been addressed. We argue that this can be addressed by considering how human expert heuristically analyze and classify their knowledge for problem solving.

In developing this approach, a rule analyzer is developed for classifying rules depending on various heuristic measures such as commonly used rules, conflicting rules, unused rules, etc. and fed into the heuristics module. If the heuristically selected rules are not sufficient to answer the question, the system explores the main KB. If this option is also failed, the user is allowed to introduce new rules to the main KB.

As time goes on, since the system avoids the unnecessary exploration of a large KB, this approach clearly reduces the reasoning time but improves the accuracy of the answers. Further, it provides a sensible mechanism to update the rule base, by KB. Our approach extends the list of traditional features of expert systems; processing of incomplete information, explaining ability, handling uncertainty, ect. By adding one more feature of heuristic-based rule analysis of human experts.

The prototype of the system is tested incrementally. At present system shows a fifty percent reduction of reasoning time on the average. This figure improves as time goes since the heuristic model evolves during the process of using the system.

E1 227

A framework for developing a computer - based mathematics learning system

Computer based learning has been one of the most significant applications of computer technology. However, the use of computer based learning has different effects depending on the area to which it is applied. For example developing the system for learning mathematics is challenging. This is because computers has a means to a physical realization of the world. In contrast mathematics promotes abstract thinking.

In addressing the above, we have exploited a learning theory to mathematics learning, and devised a computer based learning environment. This particular work exploits David Ausubel's learning theory. We used an Artificial Intelligence technique to emulate this work. In developing the system, we have postulated a three-layer architecture namely the visual level, conceptual level and abstract level. The model encourages students to use the physical realization at the entry levels of visual and conceptual levels and leads to the abstract level. Finally at the abstract level there are only numbers. The system is restricted in going backing the process, because it encourages students to learn abstract thinking and reduces the physical comprehension. As a prototype we have developed the system to teach manipulation on fractions. This has been chosen as the area of mathematics knowledge to be very poor according to a survey done on secondary education. The

development is done using Authware and Artificial Intelligence techniques and this package has been tested and is ready to be release for use at school level. Although the system is tested only for teaching manipulation of fractions. It can be used as a general framework for mathematics teaching.

E1 228

Incorporating prior information with random field linear model for prediction in computer experiments

A Bayesian approach incorporating prior information on the regression parameter in conjunction with sample information with random field linear model for prediction and exploratory data analysis of observations from multi-factor computer experiments was attempted. The observations from the computer simulation model were assumed to be from a multi-variate Gaussian stochastic process and were model using random field linear model. Bayesian predictor was built using a two-stage hierarchical model assuming a multi-variate normal prior distribution for the regression parameter in the random field linear model.

The performances of the Bayesian predictor and classical Kriging predictor were compared using observations from a six factor computer experiment with single response. Prediction capabilities were compared using mean squared error of prediction as criterion. Comparisons were also made with main effect plots and two-factor joint effect plots obtained by using the two predictors.

The mean-squared errors of predictions for the two predictors differed very slightly. Both captured non-linearities and curvatures in the data and identified the same set of influential variables. The effect of use of prior information on the regression parameter appear to shrink the main effects of the factors towards the mean.

E1 229

Birth, immigration and catastrophe process

In a number of recent publications, studies have been reported on stochastic models for the growth of populations subject to catastrophes due either to death or large scale emigrations.

This paper is a sequel to Brockwell. In this model we consider a linear birth, immigration and catastrophe process, where the size of the population may increase due to the births by the individuals in the population may increase due to the births by the individuals in the population or by the arrivals of the immigrants. The size of the population will decrease due to the deaths of individuals by catastrophes. We also

assume that the births, arrivals of immigrants and the occurring of catastrophes have independent Poisson processes.

Our objective of this study was to obtain the explicit results for stationary distribution, stationary probability and time to extinction of such process. Various extensions to the model studied are possible. Some of these are: (1) to obtain similar results for Binomial and Geometric catastrophes. (2) this result can be extended for a model with frequently occurring catastrophes

In this study we are interested to examine such processes under the influence of uniformly distributed catastrophe. If the catastrophe wiped out the entire population then it becomes extinct and the only way to increase the size of the population is by the arrivals of immigrants. The time to extinction of the process is defined by the first passage time to state zero.

E1 230

Some Algebraic Properties of Stochastic Polygons

The definition of a right stochastic polygon was introduced by Skornyakov. By analogy with ordinary polygons and using probability techniques, some definitions such as a right stochastic subpolygon, a stochastic factor polygon, a free stochastic polygon, a stochastic indecomposable polygon, can be introduced. Some basic algebraic properties of right stochastic polygons as objects of the category of the right stochastic polygons are derived in terms of isomorphism, epimorphism, coproduct and decomposability.

Theorem A free right stochastic S -polygon F with a basis X , where S is a monoid, and $X \subseteq F$, can be represented as a disjunctive union of right stochastic polygons $x_i S$, where $x_i \in X$, and each such stochastic polygon is isomorphic to the right stochastic S -polygon S , such that $S'_s (S_1, S_2) = \delta_s (S_1 S', S_2)$ for any $S', S_1, S_2 \in S$

On the set of stochastic maps $SF(X, X \times S)$ we introduce the operation $*$, such that

$$(f_1 * f_2)(x_1, x_2 s_1) = \sum \sum f_1(x_1, xs) f_2(x, x_2 s') \delta_s(s' s, s_1)$$

Then the monoid of endomorphisms of the free right stochastic S -polygon F with the basis X is isomorphic to the monoid $SF^*(X, X \times S)$ with the introduced operation $*$.

The analogous results for ordinary (nonstochastic) polygons can be found in the work of Kilp and Michalev (1986). Any stochastic polygon corresponds to the stochastic automaton without exit. The results obtained may be useful for solving decomposition problems of stochastic polygons and automata.