TETRAD FORMALISMS AND THE MOTION OF FLUIDS

G.S. Thayagaran
Dept. of Mathematics, Eastern University.

We deal with a congruence of timelike curves that fill the whole of spacetime. We assume that the unit tangent vectors to the curves form a smooth timelike vector field on the space time manifold and we further asume that there are three spacelike vector a ,b ,c , such that at each point of space tims (t , a , b , c) is a tetrad of orthogonal vectors and they satisfy the orthogonal condition.

There are 24 rotation coefficients. These rotation coefficients with the intrinsic derivatives produce a new set of formulae of 16 equations. There are 36 bivector components of the Reimannian tensor which are given by 0_{AB} (through $0_{AB} = 0_{BA}$ implies that only 21 are distinct). These bivector components be found interms of rotation coefficients and their derivatives. Then we have 6 commutator equation. All these are written in nice 3x3 matrix forms, from this, all the results are given in matrix equations.

In the case of fluid particles, the timelike curves are the world lines of fluid particles and the rotation coeficients are related to the acceleration, expansion, rotation and the shear of the fluid. First 9 rotation coefficients which are given in one 3x3 matrix are found in rotation and the expansion tensor. Conversely, the rotation (vorticity) and expansion tensor are given in rotation coefficients. Then these rotation coefficients are found in shear tensor and rotation.