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MECHANICS
SUB. CODE-BSPH1102
For B.Sc.(Physics)
Module-II (Collisions)

Elastic and inelastic collisions between particles.

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Laboratory and Centre of Mass frames of reference

- If the origin of the reference system is a point rigidly fixed to the laboratory, then the frame of reference is known as **Laboratory frame of reference**.
- The laboratory frame is inertial so long as earth is taken to be an inertial frame.
- If the origin of the reference system is a point rigidly fixed to the centre of mass of a system of particles on which no external force is acting, then the frame of reference is known as **Centre of mass frame of reference**.



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In centre of mass frame of reference,

- The position vector of centre of mass $\vec{R} = 0$
- Velocity of centre of mass $\vec{V} = \frac{d\vec{R}}{dt} = 0$
- The linear momentum of the system is zero. Hence it is known as zero momentum frame



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Advantage of Centre of Mass system

1. For isolated system, the velocity of the centre of mass is constant. Hence the centre of mass frame is also an inertial frame.
2. A system of two particles requires six coordinates to describe the motion in the laboratory system. Three coordinates for motion of centre of mass and three more coordinates to describe the relative motion. But in the centre of mass frame, we require only three coordinates as the centre of mass is itself at rest in the frame.



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Reference

Mechanics by *D. S. Mathur*, S. Chand, chp-6.9

