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Collinear Four Body Problem

In this paper, we use canonical transformations to collectively analytically continue the singularities of the simultaneous binary collision solutions for the collinear four-body problem in both the decoupled case and the coupled case. All the solutions are found and more importantly, we describe the relationship between the decoupled solutions and the coupled solutions. Also, the existence a special periodic orbit with singularity is proved and also numerical evidence is given.