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Investigating the Form of the Generalised Equations of Motion of the N-Bob Pendulum and Computing Their Solution Using MATLAB

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Abstract : Pendular systems have a range of both mathematical and engineering applications, ranging from modelling the behaviour of a continuous mass-density rope to utilisation as Tuned Mass Dampers (TMD). Thus, it is of interest to study the differential equations governing the motion of such systems. Here we attempt to generalise these equations of motion for the plane compound pendulum with a finite number of N point masses. A Lagrangian approach is taken, and we attempt to find the generalised form for the Euler-Lagrange equations of motion for the i-th bob of the N -bob pendulum. The co-ordinates are parameterized as angular quantities to reduce the number of degrees of freedom from 2N to N to simplify the form of the equations. We analyse the form of these equations up to N = 4 to determine the general form of the equation. We also develop a MATLAB program to compute a solution to the system for a given input value of N and a given set of initial conditions.

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