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Equivalence Between Geodesic and Lagrangian Formulations of Pendulum Systems on Manifolds JARED BLAND, The Richard Stockton College of New Jersey — The pendulum system may be described in terms of the Lagrangian related to the system. This Lagrangian is defined on a manifold (higher-dimensional surface) in the configuration space, which is determined from the constraints of the system. Alternatively, if a proper manifold is chosen, then the shortest paths, or geodesics, will trace out the motion of the system. This provides another method to formulate mechanics. Rather than creating constraints as in the Lagrangian approach, we find these geodesics. Both methods are rooted in solving variation problems. A basic case is presented: A two-pendulum system without gravity or coupling. Since there is no gravity the angular velocity is constant, and the answer intuitive, but the difference between the two methods may be illuminated. We also suggest related open problems, such as incorporating a surface gravity of g and coupling between the pendulums. Coupled pendula are well studied using Lagrangian mechanics for small oscillations, but not without the small oscillation assumption. We hope that the method may extend to provide insight into this and similar problems.

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