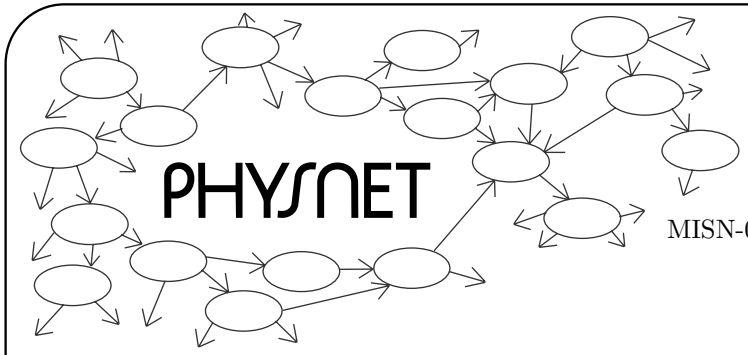

MISN-0-500

HAMILTONIAN FORMULATION

Classical Mechanics

Project PHYSNET Physics Bldg. Michigan State University East Lansing, MI

HAMILTONIAN FORMULATION

by

C. P. Frahm

Title: **Hamiltonian Formulation**

Author: C. P. Frahm, Physics Dept., Illinois State Univ

Version: 2/1/2000 Evaluation: Stage B0

Length: 2 hr; 7 pages

Input Skills:

1. Vocabulary: Hamiltonian (MISN-0-499).

Output Skills (Knowledge):

K1. Vocabulary: generalized momenta, canonically conjugate quantities.

K2. Derive Hamilton's equations of motion from the definition of the Hamiltonian in terms of the Lagrangian.

K3. Derive the virial theorem for a system with bounded position vectors and momenta.

Output Skills (Problem Solving):

S1. For a given system find the Hamiltonian function and hence write down the Hamiltonian equations of motion for the system.

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Our publications are designed: (i) to be updated quickly in response to field tests and new scientific developments; (ii) to be used in both classroom and professional settings; (iii) to show the prerequisite dependencies existing among the various chunks of physics knowledge and skill, as a guide both to mental organization and to use of the materials; and (iv) to be adapted quickly to specific user needs ranging from single-skill instruction to complete custom textbooks.

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Views expressed in a module are those of the module author(s) and are not necessarily those of other project participants.

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C. P. Frahm

1. Introduction

The formulation of mechanics due to Hamilton is particularly useful for illuminating many of the theoretical subtleties of mechanics as well as for solving certain kinds of problems in celestial mechanics and continuum mechanics. This unit is devoted to an introduction to Hamilton's formulation of mechanics.

2. Procedures

1-2. Read sections 7.10 and 7.11 of Marion. Write down definitions for the items in Output Skill K1. Fill in the details for Output Skill K2. Be sure you can do Output Skill K2 without the aid of the text and starting from Lagrange's equations and the definitions of the Hamiltonian and generalized momenta.

3. Read section 7.13 in Marion. Fill in any missing details.

4. Work problems 7-25 and 7-30 of Marion.

   Work problem 7-32 of Marion omitting the last part concerned with phase space.

Acknowledgments

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