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Course mbd WS 2010

Problem 2: Rigid MBS of Three Bodies (Usage of MBS-Programs)

The second example represents a rigid MBS, an open loop system:
Body 1 is connected to the inertial frame by a revolute joint at marker A (Fig. 2.1). Additionally, a rotational damper is active in A (damping coefficient d_T = 50 Nms/rad).

This body has the shape like a plate from aluminium (ρ = 3000 kg/m^3), a plate height (in y-direction) h = 9 mm, a plate width (in z-direction) b = 200 mm and a length (in x-direction) l = 2 m.

Body 2 - a steel plate (ρ = 7895 kg/m^3) - is rigidly attached to body 1 at marker B. Height h = 9.5 mm, width b = 200 mm and length l = 0.4 m.

Body 3 - a steel plate (ρ = 7895 kg/m^3) - is connected to body 2 at marker C by a revolute joint. Height h = 9.5 mm, width b = 200 mm and length l = 1.0 m.

Between markers D and E a linear axial spring is active with a stiffness k = 100 N/m and damping factor d = 10 Ns/m. The reference length l_0 = 1 m.

Gravity acts in negative y-direction with g = – 9.81 m/s^2.
The initial conditions are shown in the Fig. 1.

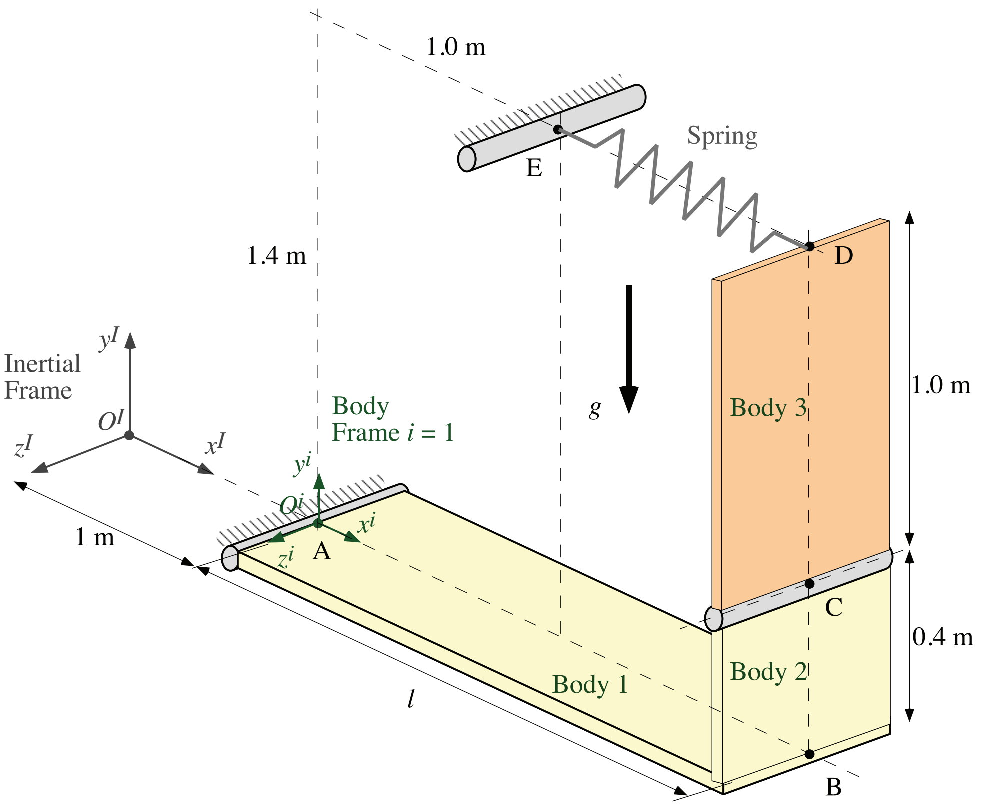

Fig 1: Example rigid 3 body MBS with spring

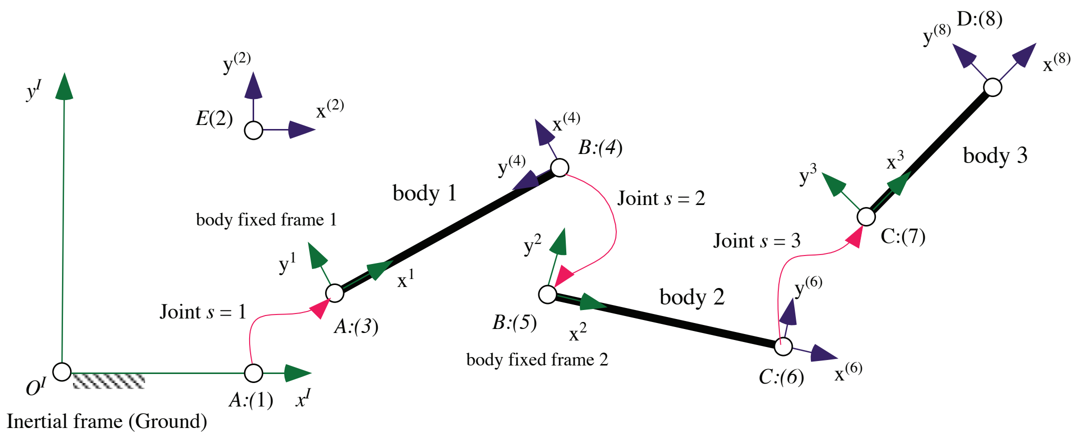

Fig 2: MBS sketch of the 3 body system

Do the following:

a) Compute MBS input data
b) Setup a MBS model, use Fig. 2 for any package and simulate the motion over 15 sec. Fig. 1 shows the initial conditions.
c) Compute the path of B, C and D in the inertial-plane
d) Compute the relative rotation of body 1 and 3 w.r.t. previous body (joint's angle and angular velocity)
e) Compute the tension force magnitude of the spring.

If body 3 penetrates body 1 add contact elements between both - if is it possible in the package.