MECA H 303: Kinematics and dynamics of machines

Partim: Dynamics and vibrations

Exercise session 3: 14/12

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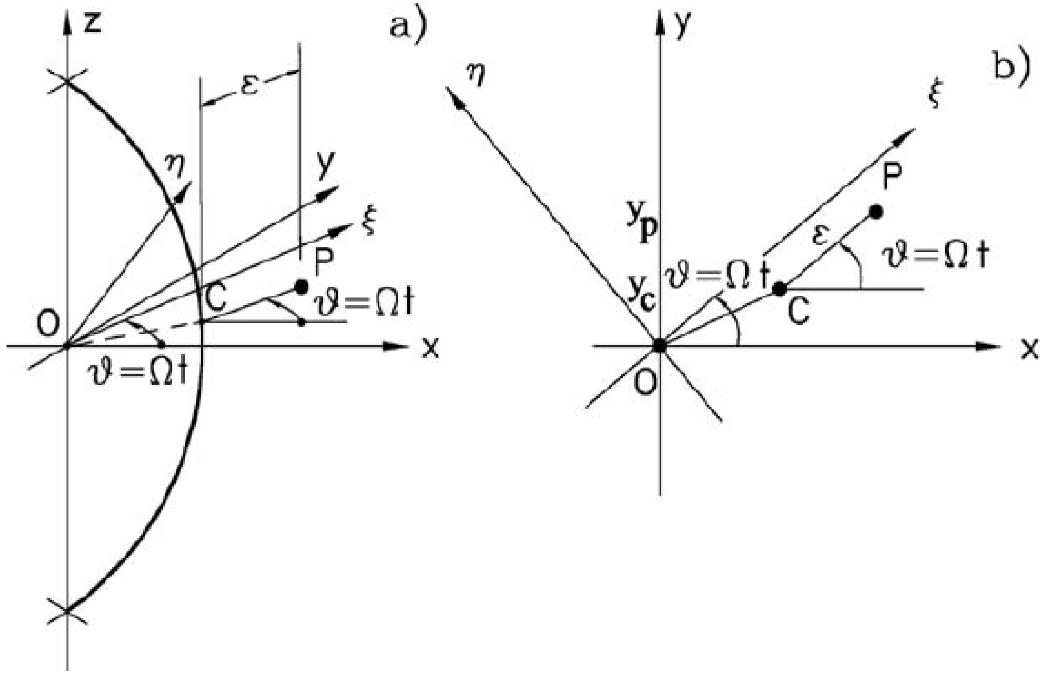
P3.1



(A): Stability condition

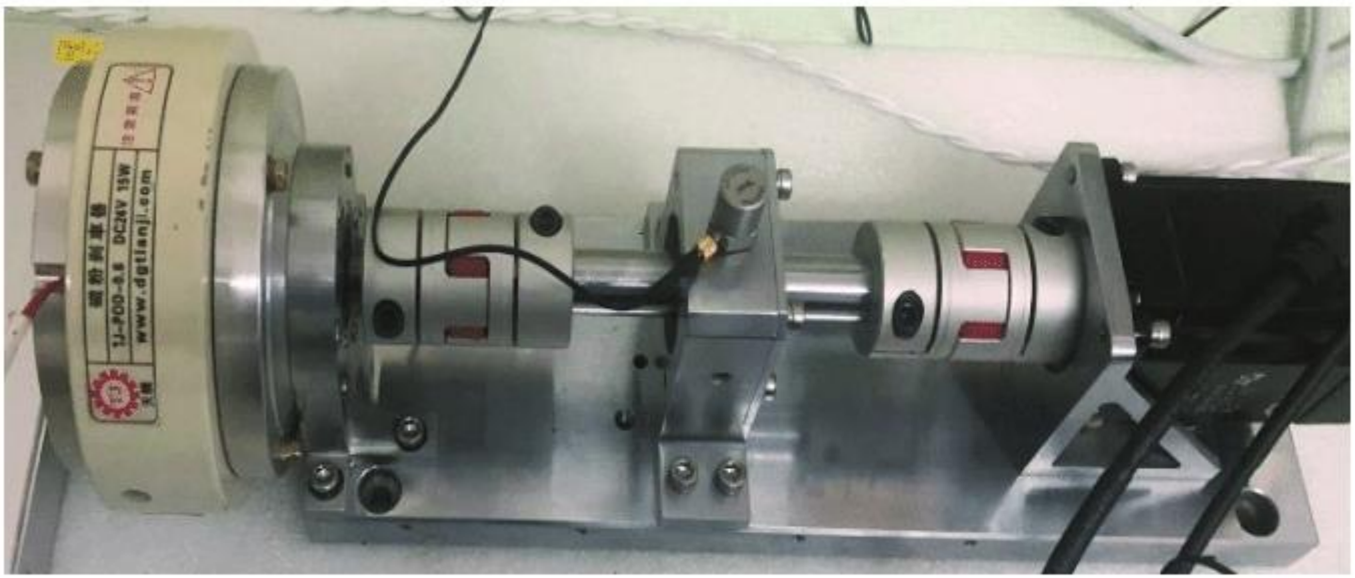
$$\Omega < \sqrt{\frac{k}{m}(1 + \frac{c_n}{c_r})}$$

Values for computation:

- $k = 3000$ N/m
- $m = 400$ kg
- $c_r = 200$ N/(m/s)
- $c_n = 4000$ N/(m/s)

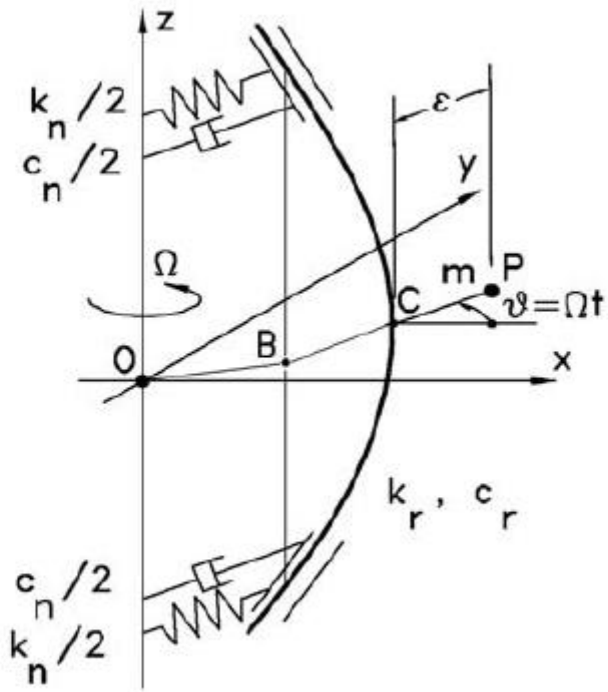
- Consider a Jeffcott rotor with damping under Free whirl conditions
- Express the differential equations of movement
- Extract the real and imaginary parts from the roots of the equation
- Show that the system is stable ($\sigma_1 < 0$) if equation (A) is fulfilled
- Calculate the value of the maximum rotating frequency for which the system is stable with the given values

P3.2



- What is the torque that the motor needs to apply to the system to achieve constant rotor speed
- Assume the case of a Jeffcott rotor with damping

P3.3



- Assume we have a Jeffcott rotor with compliant bearings
- Write the equations governing the dynamics of the system
- Assuming there is no damping, calculate the critical speed
- Assume massless bearings