

University of British Columbia  
Department of Mechanical Engineering

MECH366 Modeling of Mechatronic Systems  
Homework 3

**Due: October 7 (Monday), 2019, 3pm**

For the gear-train system depicted below derive the state equation by using the linear graph (output equation is not necessary). The notations are explained in the following table. Masses of the flexible shafts are assumed to be negligible. The input is the motor torque  $T$  [Nm].

Notation	Unit	Meaning
$J_m$	$[\text{kg}\cdot\text{m}^2]$	Moment of inertia of the motor
$J_L$	$[\text{kg}\cdot\text{m}^2]$	Moment of inertia of the load
$J_\ell, J_r$	$[\text{kg}\cdot\text{m}^2]$	Lumped moment of inertia of the gears
$k_i, i = 1, 2, 3$	$[\text{Nm}/\text{rad}]$	Torsional spring constants
$N_i, i = 1, 2, 3, 4$	$[-]$	The number of gear teeth
$b$	$[\text{Nm}/(\text{rad}/\text{s})]$	Rotational friction for the load

