November 16th, 2025

Homework assignment
(computational project)

Deadline: January 17th, 2026
Course: Dynamics of Multibody System

Complete two tasks:

1. Prepare the ADAMS model of the mechanism shown in the Figure and perform kinematic analysis.
2. Write a computer program for kinematic analysis of this mechanism. The program should be written and tested in MATLAB environment. The mechanism must be described in absolute coordinates.

Hints and requirements:

1. Start with the ADAMS model. You may use it later on as a reference for your MATLAB program.
2. Assume that length x_k of the k^{th} actuator is a function of time t:
$$x_k = l_k + a_k \sin(\omega_k t + \varphi_k) ,$$
and choose reasonable values of constants l_k, a_k, ω_k and φ_k.
3. The program should be able to calculate and plot positions, velocities, and accelerations of points marked with letters (e.g., c_i, A, B, K, etc.) in the defined interval of time $<t_0,t_k>$, with certain time step h, for the velocities defined above. Take the starting position of the mechanism (at time t_0) close to this shown in the Figure. You may choose freely the time instant t_k of the end of simulation and step h, but your choice should be sensible.
4. The program should be able to detect the singularity of the Jacobian matrix and issue an appropriate warning message.
5. You may freely choose the other constants (the reasonable values), like the accuracy of constraint equations fulfillment or the allowed number of iterations in the Newton method.
6. The program must contain line comments explaining the code in detail.
7. Your work must be documented, and the written report should contain the following:
    - Concise theoretical background
    - ADAMS model (cmd format) (attached)
    - Programs in MATLAB (attached)
    - Short description of procedures
    - Demonstration of results.
    - Comparison of results obtained using ADAMS and MATLAB models (examples of accelerations, velocities, and positions of selected points)
    - Conclusions
8. You may use parts of the attached demo program (prepared for kinematic analysis of the mechanism discussed in examples 5.1 – 5.5).
9. For advice, please get in touch with mgr inż. Maciej Pikuliński