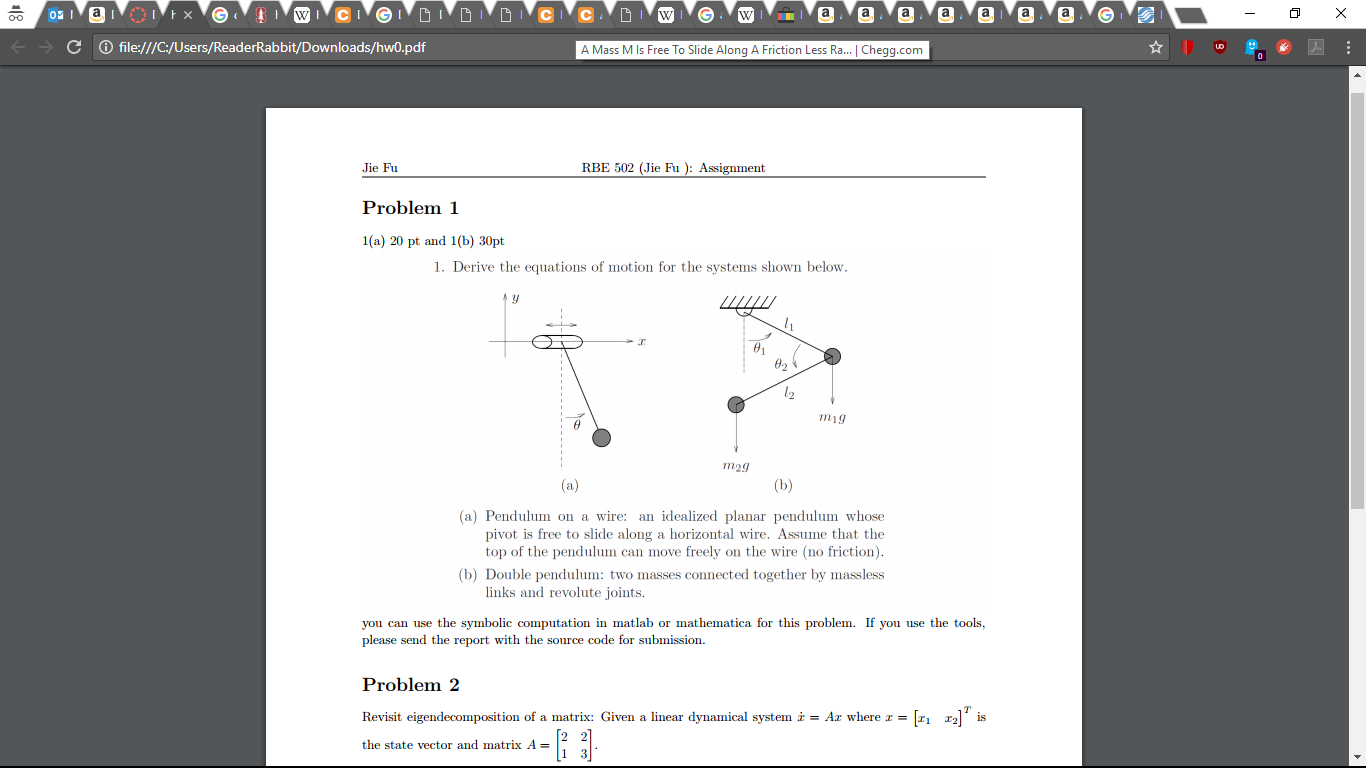
RBE 502

HW 0 Solution

**P1.** Derive the equations of motion for the systems shown below. You can use the symbolic computation in matlab or mathematica for this problem. If you use the tools, please send the report with the source code for submission.

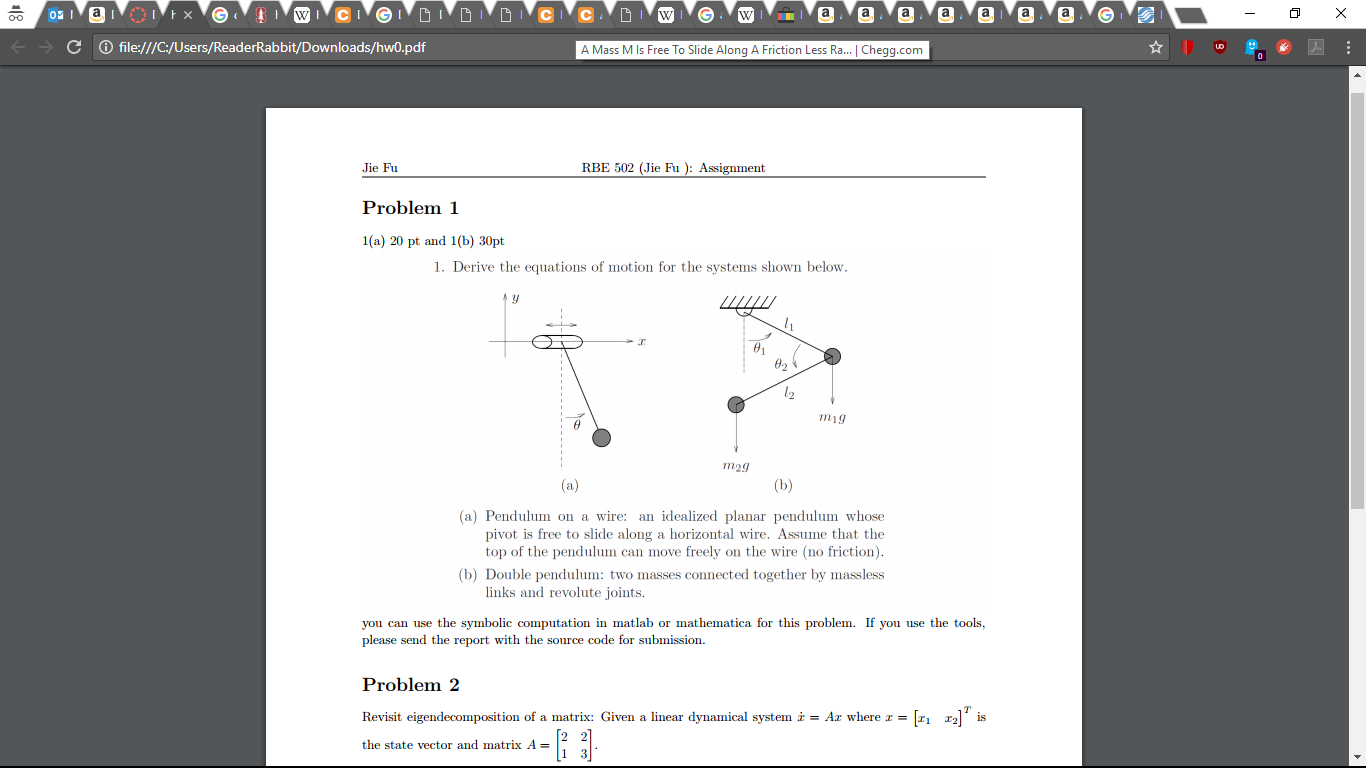


a) (20pt) Pendulum on a wire: an idealized planar pendulum whose pivot is free to slide along a horizontal wire. Assume that the top of the pendulum can move freely on the wire (no friction).

Chain rule:

Potential Energy is at its lowest, 0, when

or



b) (30pt) Double pendulum: two masses connected together by massless links and revolute joints.

Chain rule:

Potential Energy is at its lowest, 0, when

or

**P2.** Revisit eigendecomposition of a matrix: Given a linear dynamical system where is the state vector and matrix .

1. (10pt) Compute the eigenvalues and corresponding eigenvectors of . Let , be the computed eigenvectors for eigenvalues , .

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Substitute in

Substitute in

1. (10pt) Show that satisfies that .

1. (10pt) Consider a change of basis, i.e., . What is the differential equation using as the state variable? Present your derivation steps.

1. (20pt) Can you obtain the solution of the differential equation using as the state variables? If yes, compute the solution of the original ode using the solution of . hint: first solve the ode with variable , and then solve for using the relation that .