

# Ackermann, Robust Control, WS 2010/11

## Exercise 1 (Submission 29. October 2010)

Consider a modification of the crane system as follows: The rope is replaced by a massless stick. The crab has a vertical opening with bearing for the stick in the crab CG and the stick extends also upwards. For  $\ell < 0$  this is an “inverted pendulum”.

1. What happens with the eigenvalues as  $\ell$  passes through zero.
2. What are the stability conditions on the four state feedback gains in the case  $\ell < 0$  ?
3. Is it possible to stabilize simultaneously a crane and an inverted pendulum by a fixed state feedback controller?