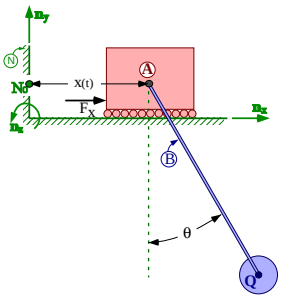
22.6.4 MG road-map: Bridge crane equations of motion



A payload (particle) Q is attached to the end of a light rigid cable B which swings in a Newtonian reference frame N. Cable B is connected to a massive trolley A (modeled as a particle). Trolley A moves horizontally along a smooth slot fixed in N with a **specified** (known) displacement $x(t)$ due to a force of measure F_x (a linear actuator connects A to a point N_o of N). All motion is in a vertical plane perpendicular to the unit vector $\hat{\mathbf{n}}_z$ fixed in N.

Complete the ***MG road-map*** for B's "pendulum angle" θ and the actuator force F_x required to translate A with specified displacement $x(t)$.

Variable	Translate/ Rotate	Direction (unit vector)	System S	FBD of S	About point*	***MG road-map equation*** equation
θ	Rotate	$\hat{\mathbf{n}}_z$	B, Q	**Draw**	A	$\hat{\mathbf{n}}_z \cdot (\vec{\mathbf{M}}^{S/A} = \frac{{}^N d\, {}^N \vec{\mathbf{H}}^{S/A}}{dt} + \ldots)$
F_x	Translate	$\hat{\mathbf{n}}_x$	A, B, Q	**Draw**	Not applicable	$\hat{\mathbf{n}}_x \cdot (\vec{\mathbf{F}}^{S} = m^S\, {}^N\vec{\mathbf{a}}^{S_{cm}})$
θ	**Dot(Nz> , System(B, Q).GetDynamics(A))**					**M**otion**G**enesis command ©
F_x	**Dot(Nx> , System(A, B, Q).GetDynamics( ))**					**M**otion**G**enesis command ©

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