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A numerical investigation of a simplified human birth model
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The George Washington University — This work uses a simplified model to explore
the forces experienced by the fetus during human birth. Numerical results are com-
pared with the results of a physical model representing the fetus moving through the
birth canal using a rigid cylinder (fetus) that moves at a constant velocity through
the center of a passive elastic tube (birth canal). The entire system is immersed
in a highly viscous fluid. Numerical simulations are run at low and zero Reynolds
numbers. In each case, the pulling force necessary to move the rigid inner cylinder at
a constant velocity through the tube is measured. The discrete elastic tube through
which the rigid cylinder passes has macroscopic elasticity matched to the tube used
in the physical experiment. The buckling behavior of the elastic tube is explored by
varying velocity, length, and diameter of the rigid cylinder, and length of the elastic
tube. More complex geometries as well as peristaltic activation of the elastic tube
can be added to the model to provide more insight into the relationship between
force and velocity during human birth.

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