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The dynamics of three-dimensional liquid bridges with pinned and moving contact lines SATISH KUMAR, SHAWN DODDS, University of Minnesota, MARCIO CARVALHO, PUC-Rio (Brazil) — Liquid bridges with moving contact lines are relevant in a variety of natural and industrial settings, ranging from printing processes to the feeding of birds. While it is often assumed that the liquid bridge is two-dimensional, three-dimensional effects are prominent in many applications. To investigate this we solve Stokes equations using the finite element method for the stretching of a three-dimensional liquid bridge between two flat surfaces, one stationary and one moving. We find that whereas a shearing motion does not alter the distribution of liquid between the two plates, rotation leads to an increase in the amount of liquid resting on the stationary plate as breakup is approached. This suggests that a relative rotation of one surface can be used to improve liquid transfer to the other surface. We then consider the extension of non-cylindrical bridges with moving contact lines. We find that dynamic wetting, characterized through a contact line friction parameter, plays a key role in preventing the contact line from deviating significantly from its original shape as breakup is approached. By adjusting the friction on both plates it is possible to drastically improve the amount of liquid transferred to one surface while maintaining fidelity of the liquid pattern.

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