## Shaving Challenge

Brady Metherall

14 October, 2019

main paper, [4]

kinds of hair (anagen and telegen), prediciton of hair growth and hair removal methods, two models for hair growth [6]

model shape of hair using euler bernoulli for beam deflection [1]

## 1 Effect of shaving on growth

clipping stimusates hair growth is some species by incuding anagen, effect of shaving on hair production (legs), shaving does not stimutae growth or increase growth rate [5] face shaving effect on beard growth, hairs cut at 45 angle, shaving had no effect on growth [9]

## 2 Food

In addition to models specific to hair, there have been multiple attempts to model slicing and cutting more generally. Typically these models have been developed for industrial food production. These models take one of two approaches—derived from energy conservation [7, 8] or from stress tensors [8]. Furthermore, while cutting there are two axes of motion, pushing the blade downwards into the media and dragging the blade along the surface. Each of these motions is itself ineffective at cutting, and a optimal 'push / slice' ratio exists [2, 3]. This notion also explains why straight razors usually do not pose a threat to a cut—the razor is moved perpendicular to the blade and thus, there is no slicing motion.

## References

- [1] S. Howison, *Practical Applied Mathematics*. Cambridge Texts in Applied Mathematics, Cambridge University Press, 2005.
- [2] A. G. Atkins, X. Xu, and G. Jeronimidis, "Cutting, by 'Pressing and Slicing', of Thin Floppy Slices of Materials Illustrated by Experiments on Cheddar Cheese and Salami," *Journal of Materials Science*, vol. 39, pp. 2761–2766, 2004.
- [3] A. G. Atkins and X. Xu, "Slicing of Soft Flexible Solids with Industrial Applications," *International Journal of Mechanical Sciences*, vol. 47, pp. 479–492, 2005.
- [4] A. D. Fitt, A. A. Lacey, and P. Wilmott, "On the Optimum Hand Speed for Two-Blde Razor Shaving," *Teaching Mathematics and its Applications*, vol. 10, no. 3, pp. 122–126, 1991.
- [5] Y. L. Lynfield and P. MacWilliams, "Shaving and Hair Growth," *The Journal of Investigative Dermatology*, vol. 55, no. 3, 1970.
- [6] V. Kolinko and C. M. Littler, "Mathematical Modeling for the Prediction and Optimization of Laser Hair Removal," Lasers in Surgery and Medicine, vol. 26, pp. 164–176, 2000.
- [7] O. Gubenia and V. Guts, "Modeling of Cutting of Food Products," 2010.
- [8] D. Zhou and G. McMurray, "Slicing Cuts on Food Materials Using Robotic-Controlled Razor Blade," *Modelling Simulation in Engineering*, vol. 2011, 2011.
- [9] M. Trotter, "Hair Growth and Shaving," *The Anatomical Record*, vol. 37, no. 4, pp. 373–379, 1928.