MATH 374 Final Project Outline
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The final project will be about the topic of **Fixed Point Theory and its applications to PDEs**. An important theorem of the theory is the Cauchy-Peano Theorem which guarantees a solutions for differential equation in the form of

$$\dot{y}(t) \;=\; f(y,t) \quad \text{and} \quad y(t_0) = y_0 \tag{0.1}$$

for minimal conditions over the function f. Upon a precursory research, it is possible to solve physical problems such as the obstacle problem or the bending rod problem using fixed point methods. I intend to give a vague justification of the theorem and apply the theorem to demonstrate the Euler Lagrange equations. Finally, using the developed methods, I will solve the two toy models presented above.

References

1. University of Oxford. *Fixed Point Theory Course Materials*. Available at: `https://courses.maths.ox.ac.uk/course/view.php?id=170`. Accessed November 24, 2024.

2. Agarwal, R. P., Meehan, M., & O'Regan, D. (2001). *Contractions*. In *Fixed Point Theory and Applications* (pp. 1–11). Cambridge Tracts in Mathematics. Cambridge University Press.

3. Albert, J. (2019). *Physical Applications of Fixed Point Methods in Differential Equations*. University of Chicago. Available at: `https://math.uchicago.edu/~may/REU2019/REUPapers/Albert.pdf`. Accessed November 24, 2024.