TEXAS STATE UNIVERSITY

The rising STAR *of Texas*

Differential Equations and Applied Math Seminar

Dr. Ray Treinen, Texas State University

11am-12pm March 1st, 2019

336 Derrick Hall

Title: On the asymptotic behavior of solutions to Hele-Shaw problems with curvature

Abstract: Given a bounded domain $D \in \mathbb{R}^2$, a simple closed curve s_0 surrounding D, and a continuous function $p(x,t)$ defined on ∂D for $t \geq 0$, find u and $s(x,t)$ such that

$$\begin{aligned} S(t) &:= \{x \in \mathbb{R}^2 : s(x,t) < 0\} & \\ \Delta_x u &= 0 & \text{in } S(t) \setminus D \\ u(x,t) &= 0 & \text{for } x \in \partial S(t) \\ u(x,t) &= p(x,t) > 0 & \text{for } (x,t) \in \partial D \times (0,\infty) \\ \tfrac{\partial s}{\partial t} &= \alpha \nabla_x u \cdot \nabla_x s + \beta\kappa & \text{on } \{(x,t) : s(x,t) = 0\} \\ s_0 &= \{x \in \mathbb{R}^2 : s(x,0) = 0\}. & \end{aligned}$$

Here κ is the mean curvature of the free boundary and α and β are physical constants giving components of the velocity. We will discuss radially symmetric solutions to this problem, and a steady state solution. We will prove that when the conditions admit a steady state solution all other solutions converge to the steady state solution in time, and the difference in solutions decays at least exponentially fast.

Interested faculty and graduate students are encouraged to attend.