An elliptic system arising in a model of stagnation point flame*

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This talk will be devoted to the study of a model that describes certain flames known as the stagnation point flames: when a two dimensional jet of combustible mixture impiges on a heated wall, a flame will usually form near the surface of the wall, if the velocity of the flow is not too high. The problem can be described by a system of elliptic PDE's.

$$\left\{\begin{array}{ll} u''+axu'+vg(u)=0 & \text{for} \quad x>0, \\ v''+axv'-vg(u)=0 & \text{for} \quad x>0 \\ u'(0)=v'(0)=0 \qquad u(+\infty)=0 & v(+\infty)=1, \end{array}\right. \tag{S}$$

where g is an increasing function having an ignition temperature. For the special case $Le=1$, the system reduces to a single ODE. Using a topological degree argument, we have obtained the existence of *exactly* two solutions when the velocity of the flow is less than a critical extinction velocity, above which there is no solution. We have proved the stability of the upper solution and the instability of the lower solution. A bifurcation result around $Le=1$ gives existence of solutions for the whole system (S). One would like to extend this result when Le is much larger than one, since then the behaviour changes. An open question would be to generalize sub and super solutions techniques to this kind of system, since numerically there is a monotonicity property.

*joint work with Henri Berestycki