



Mês de: **Abril 2008**

## SEMINÁRIOS DE ANÁLISE

**Dia 17 de Abril (quinta-feira), às 16h30, na Sala B3-01**

**Analysis and numerical approximation of singular boundary value problems  
involving the one-dimensional p-laplacian**

(Joint work with L. Morgado)

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### Abstract:

In this work our concern is to find the positive solution of the generalized Emden-Fowler equation

$$(|g'(u)|^{p-2} g'(u))' = au^\sigma g^n(u), \quad 0 < u < u_0, \quad (1)$$

where  $n < 0$ ,  $a < 0$ ,  $p > 1$ ,  $u_0 > 0$  and  $\sigma \in \mathbb{R}$ , that satisfies the boundary conditions

$$\begin{aligned} g'(0) &= 0 \\ g(u_0) &= \lim_{u \rightarrow u_0^-} [(u_0 - u) g'(u)] = 0. \end{aligned} \quad (2)$$

The differential operator on the left-hand side of (1) is the one-dimensional  $p$ -laplacian,  $\Delta_p g$ , which reduces to the classical laplacian when  $p = 2$  and, for  $p \neq 2$ , is used in nonlinear models of physical phenomena, as for example, the deformation of a nonlinear elastic membrane and problems arising in non-newtonian fluid mechanics.

The proposed approach is based on the analysis of the asymptotic behavior of the solutions of the considered ordinary differential equation near the singularities. The obtained expansions are generalizations of the previously obtained results for the case of the classical laplacian. Upper and lower solutions are introduced, which can be used as initial approximations for the computation of approximate solutions. In some particular cases, a closed formula is obtained for the exact solution. Computational methods were applied which take into account the asymptotic behavior of the solution. Numerical results are presented and discussed.

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