

Math 379 – Homework 9

Peyam Tabrizian

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Problem 1: Consider the following ODE on $(0, 1)$, where $u^\epsilon = u^\epsilon(x)$:

$$\begin{cases} \epsilon u_{xx}^\epsilon + u_x^\epsilon = 2x \\ u^\epsilon(0) = 1, u^\epsilon(1) = 1 \end{cases}$$

We expect there to be a boundary layer at $x = 0$. Follow the method used in lecture to find a good approximation u^* of u^ϵ that incorporates the boundary layer. You only need to limit yourself to the $O(1)$ -terms. For the matching-part, you may use any method that you wish.

Problem 2: Consider the following ODE on $(0, 1)$, where $u^\epsilon = u^\epsilon(x)$.

$$\begin{cases} \epsilon u_{xx}^\epsilon + u_x^\epsilon + u^\epsilon = 0 \\ u^\epsilon(0) = 0, u^\epsilon(1) = 1 \end{cases}$$

We expect there to be a boundary layer at $x = 0$. Follow the method used in lecture to find a good approximation u^* of u^ϵ that incorporates the boundary layer. This time, go up to the $O(\epsilon)$ -terms. For the matching part, you may use any method you wish (but I think you'll be forced to apply Method 2).