1038-65-216 **Victor Nistor*** (nistor@math.psu.edu), Mathematics Department, University Park, PA 16802, **Hengguang Li Li** (li_h@math.psu.edu), Mathematics Department, University Park, PA 16802, and **Anna Mazzucato** (mazzucat@math.psu.edu), Mathematics Department, University Park, PA 16802. *Quasi-optimal meshes for transmission problems in the plane.*

We consider an elliptic (transmission) boundary value problem of the form $\text{div} a \nabla u = f$ on a polygonal domain. We allow the coefficient a to have jump discontinuities on a piecewise smooth interface. We also allow mixed boundary conditions. We prove regularity and well-posedness results for this elliptic problem. The case of Neumann-Neumann vertices and the non-smooth points of the inteface require a new type of well-posedness result, which includes also "the first singular function" at each of these singularities. These results then allow us to construct a sequence of meshes with associated Finite Element Spaces S_n (using degree m piecewise polynomials), such that $\|u - u_n\|_1 \leq C(\dim S_n)^{-m/2}\|f\|_{m+1}$. No artificial assumption on the smoothness of u is made. This optimal rate of convergence result is proved using weighted Sobolev space norm estimates for u. Joint work with Anna Mazzucato and Hengguang Li (Received February 10, 2008)