On the accuracy of finite element approximations to a class of interface problems

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We consider piecewise linear approximations to a class of interface problems were the jump of the solution and its normal derivative are prescribed on the interface. We define a simple finite element method that that corrects the right hand side of the natural finite element method for this problem to render it second order accurate. Nearly second order accuracy is proved on general quasi-uniform triangular meshes. Although the natural method is far from optimal near the interface, we show that it is optimal for points that are sqrt{log(1/h) h} away from the interface. This is joint work with Manuel Sanchez-Uribe and Marcus Sarkis.