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Application of a least-square weighted residual method based global model to simulations of material processing plasmas[1] SERGEY AVERKIN, THOMAS JENKINS, Tech-X Corporation — Global models are widely used for quick estimation of volume-averaged plasma parameters (number densities of plasma components, or electron temperatures) in partially-ionized plasmas. Such plasma discharges may contain thousands of species and hundreds of thousands of chemical reactions that are relevant to material processing. A major drawback of global models is the lack of spatial resolution, which can be critical in some cases. However, fluid simulations with the necessary spatial resolution are computationally limited (even in 1D) to relatively simple cases using fewer reactive species and chemical reactions. To fill this gap we have developed a novel formulation of global model equations that allows us to estimate the spatial variation of plasma parameters in 1D, with computational costs that are comparable to conventional global models. The model uses a rational functional representation of various plasma properties; profiles are reconstructed using least-square weighted residual methods that minimize the L^2 norm of the residual of 1-D multi-fluid equations. Optimal fitting parameters can thus be obtained for all plasma components. In this work we present an application of the method to chlorine plasma, which has many practical applications for material processing.

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