1100-37-128 **Shuguan Ji**, **Weishi Liu** and **Mingji Zhang*** (mzhang@math.msu.edu), 619 Red Cedar Road, Room C314, East Lansing, MI 48824. *Poisson-Nernst-Planck (PNP) systems for ion flow through membrane channels: Permanent charge effects on I-V relations.*

In this work, we analyze a one-dimential steady-state Possion-Nernst-Planck system for ionic flow through a membrane channel from one reservoir to another with fixed boundary ion concentrations (charges) and electric potentials. We study the PNP system for two ion species, one positively charged and one negatively charged, with three regions of piecewise constant permanent charge. Reservoirs are represented by outer regions with zero permanent charge. The model is treated as a boundary value problem (BVP) of a singularly perturbed differential system. Our analysis is based on the geometric singular perturbation theory but, most importantly, on specific structures of this concrete model. The existence of solutions to the BVP for small permanent charge is established, and treating the permanent charge as a small parameter, we also derive an approximation of the I-V (current-voltage) relation and identify two critical potentials or voltages for permanent charge effects. Under electroneutrality conditions, the two critical potentials separate the potential into three regions over which the permanent charge effects are qualitatively opposite, more precisely, the effects are the same over two of the regions and, opposite to the third one determined by the boundary ion concentrations. (Received February 05, 2014)