1125-93-1552 **Nak-seung Patrick Hyun*** (nhyun3@gatech.edu) and **Erik I Verriest** (erik.verriest@ece.gatech.edu). *A Causal Impact Modeling in Impulsive Systems using Non-standard Analysis.*

A new approach based on nonstandard analysis (NSA) for modeling nonlinear impulsive system is proposed. An extended real space is constructed as a proper subspace of hyperreals in NSA with a countable basis. The extended space is then decomposed into two parts, a *sensible* (reals) part and an *insensible* (infinitesimals) part, which insensible parts are further decomposed depends on the convergence rate of infinitesimals. Next, a hyperreal-valued Heaviside functions on the extended space is point-wise well defined via a sequence approach, where its restriction function to insensible part is denoted as a *shape* function. Depending on the shape function and its domain on insensible part, a class of distinct Heaviside functions is proposed. In addition, a generalization of the differential operator in NSA is proposed, and used to represent singular functions as regular ones on the extended space. The key idea is that a discontinuous function can be not only continuized in the insensible part but also differentiated in the infinitesimal space. A causal way for characterizing jumps in discontinuous system follows by converting the classical impulsive differential equation (IDE) with a generalized IDE that involves the newly defined singular function. (Received September 17, 2016)