Abstract
In this study Tennessee Eastman (TE) process which includes 5 single process units (reactor, condenser, vapor-liquid separator, stripping tower and compressor) is selected to carry out control studies. Inherent instability of the process, recycle flows and nearness of the operating condition to shut down limit makes it difficult to study the system. McAvoy structure has been selected to implement directional compensators on suitable model using SIMULINK in MATLAB environment. Designing of compensators is accomplished using 5 different methods (a classic method, an extension method and 3 proposed methods). At first clipping method is implemented on slave and master loops. Nonlinear and unconstraint optimal directional compensator for solving available objective function is considered in the second proposed method. Whereas in third proposed method, compensator is based on nearest solution to the final steady state point and one-step ahead algorithm is used to get to the steady state point. Fourth method (proposed) indeed is an extension of third one in which final steady state is achieved in using N steps. Finally, in fifth method (proposed), a general formulation for solving available quadratic objective function in directional compensator is rendered using MATLAB quadratic programming. Results show that implementing the above-mentioned compensators on processes confronted with inputs saturation, especially TE plant, improves process performance.

Keywords: **1**- Directionality, **2-**Input saturation, **3-**Tennessee-Eastman process, **4-** Process control, **5-**Quadratic programming