EXTRUDER DESIGN IN VIRTUAL ENVIRONMENT

CECD
CENTER FOR ENERGETIC CONCEPTS DEVELOPMENT

UNIVERSITY OF MARYLAND 18 56

NAVSEA
INDIAN HEAD
Surface Warfare Center Division

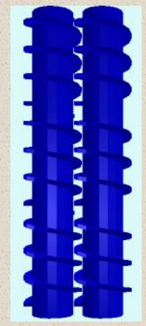
Adel Elsabbagh, PhD. Student - Dr. A. Baz, Professor - Dr. D. K. Anand, Professor

Objective

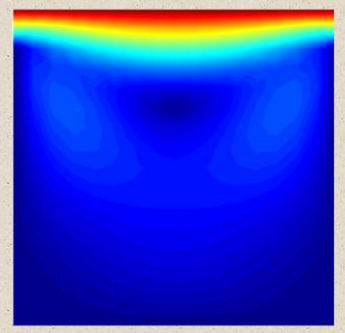
Extruders are widely used in the processing of polymers and energetic materials.

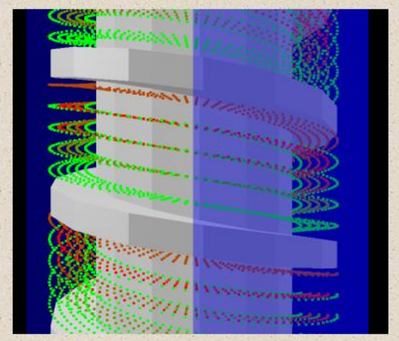
Our objective is to make the design of the extruder screw an interactive process, in which the designer can *see* the quality of the product in a real-time as influenced by the design parameters. This will be done by immersing the designer in a virtual reality environment.

Full Control



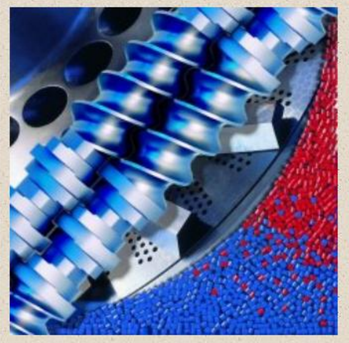
A typical screw includes several segments having different pitches, flank widths, channel depths, etc. That is why, it has been important to have a segmental wise control of all parameters. The designer can get whatever screw design he wants just with few clicks, and most importantly all of it is carried in a real-time.



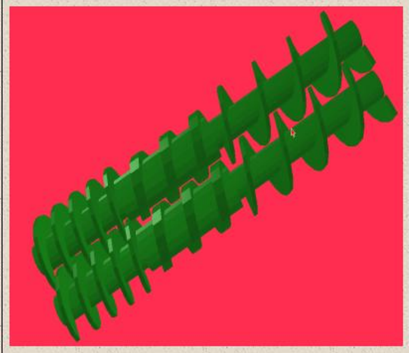


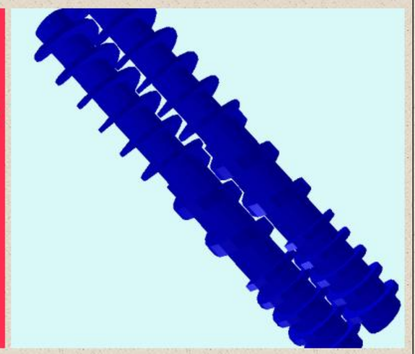
Flow Field in extruders

Screw Design



Screw is the heart of the extruder and its design determines the total performance. Finding the suitable combination of all parameters is the major concern of the screw designer. Optimal selection of these parameters will be carried out in the virtual reality environment.



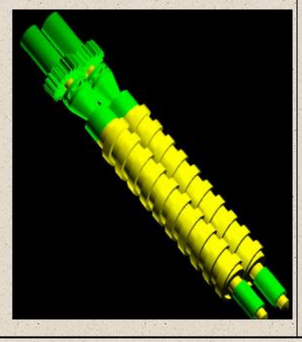


Extrusion

The extrudate is represented by a grid of points whose density is prescribed. The color of these points is indicative of a fluid property, under consideration, as speed or pressure. The solution of the Stokes equation is computationally expensive and therefore until now, is not solved in real-time. One has to solve these equations separately and then implement the solution in the VR environment.

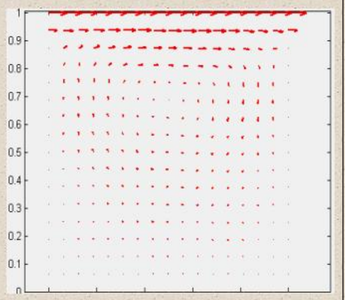
VR Environment

Virtual Reality (VR) provides an interactive environment for the designer to investigate multiple design changes. In the VR, models of intermeshing twin screws are implemented and control of all its parameters including the center distance, length, pitch, helix angle, flank width, and channel depth have been achieved.



The Problem

Models of twin screw extruders have been developed, and emphasis is placed now on modeling the process itself. Therefore, classical 2-D viscous flow in rotating channels have been implemented in the VR environment.



Next Step?

We have succeeded in making the screw design an interactive process, in which the designer can choose in *real-time* whatever configuration of parameters he wants. More realistic models for fluid flow will be developed including a 3-D model for the flow in twin screw extruders. Our ultimate goal will be to develop a fast solver to visualize the effect of changes in the design parameters on the quality of mixing of the extrudate in real-time.