Industrial Software for Computer Aided Process Engineering (CAPE) Modeling and Programming Skills Development

Jeffrey D. Kelly,[a,*] Brenno C. Menezes,[b]

aIndustrial Algorithms Ltd., 15 St. Andrews Road, Toronto M1P 4C3, Canada

bDivision of Engineering Management and Decision Sciences, College of Science and Engineering, Hamad Bin Khalifa University, Qatar Foundation, Doha, Qatar

jdkelly@industrialgorithms.ca

Abstract

The Industrial Modeling and Programming Language (IMPL) software designed for the process system engineering (PSE) and operations research (OR) communities is architected to be a structural unit-operation-port-state superstructure (UOPSS) and a semantic quantity-logic-quality phenomena (QLQP) modeling language embedded into a computer programming language with the capability to model and solve industrial optimization, estimation or simulation problems (or sub-problems). In such computer aided process engineering (CAPE) systems, to evolve towards the requirements of advanced modeling and programming skills in a staged fashion, there is a mixture, blend or combination of IML (Industrial Modeling Language), IPL (Industrial Programming Language) and IMPC (Industrial Modeling and Programming Code) for convenience, expressiveness and expedience. IML is how the user may configure the problem using a flat file to fill specific fields or frames by configuring (without coding) the embedded sets (from the UOPSS and QLQP), parameters, variables, and constraints. IPL is how a user may code problems by using computer programming languages to manipulate IMPL using any of its receiving and retrieving routines and with and without using the IML facilities for configuration when required. IMPC is implemented into a machine-coded language (Intel Fortran) to allow IMPL's modeling facilities to be combined with a powerful general-purpose programming language to formulate any new type of set, parameter, variable and/or constraint. To summarize, IMPL may be considered as a confluence with the scientific disciplines of applied engineering, information and computing technologies, statistics, data analytics and decision sciences, that deliveries easy-to-handle and integrative capabilities for modeling and programming in a progressive-learning evolution and high-performance shareable work amongst PSE and OR teams.

Keywords: Modeling languages, Programming skills, Industrial Modeling and Programming Language, Computer programming languages, Exploitation of CAPE tools.

1. Introduction

To progress from a mere user of commercial software solutions supplied by vendors to the development of home-grown tools highly demanded in the process system engineering (PSE) and operations research (OR) communities in both academia and industry, there is a need for handy, integrative-method, progressive-learning and shared-work modeling and programming capabilities that are not difficult and costly to develop,