MANUAL

FORCE-RTM
Revision 0
Printed March 2022

FORCE Requirements Traceability Matrix

Konor Frick, Paul Talbot

Prepared by
Idaho National Laboratory
Idaho Falls, Idaho 83415

The Idaho National Laboratory is a multiprogram laboratory operated by
Battelle Energy Alliance for the United States Department of Energy
under DOE Idaho Operations Office. Contract DE-AC07-05ID14517.

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1 Introduction

The Framework for Optimization of ResourCes and Economics is a collection of software tools,models, and datasets acquired and developed under the Integrated Energy Systems (IES) program to enable analysis of technical and economic viability of myriad IES configurations. FORCE is the consolidating interface and data repository for all the IES toolsets ranging from macrotechnoeconomic analysis to transient process modeling and experimental validation for integrated energy systems. This document is aimed to report the FORCE software traceability matrix.

1.1 Other Design Documentation

Also available within the repository is the FORCE User manual within the "docs" folder. This user manual gives a detailed explanation of the installation process, system dependencies alongside links upon which where to find them, and an explanation of the use cases within the repository.

1.2 Dependencies and Limitations

The software should be designed with the fewest possible constraints. The only primary constraint is:

1. Python 3 – `https://docs.conda.io/en/latest/miniconda.html`

However, enhanced capabilities will require the installation of the aforementioned plugins (HYBRID, HERON, RAVEN, TEAL) which have the dependencies shown below.

RAVEN

1. Visual Studio Community Edition – Link Available on the raven github
2. Raven specific python library set. – Available through the install process.

HERON, TEAL

1. Risk Analysis and Virtual ENviroment (RAVEN) – `https://raven.inl.gov/SitePages/Software%20Infrastructure.aspx`

HYBRID

1. Commercial Modelica platform Dymola – https://www.3ds.com/products-services/catia/products/dymola/latest-release/

2 References

- ASME NQA 1 2008 with the NQA-1a-2009 addenda, "Quality Assurance Requirements for Nuclear Facility Applications," First Edition, August 31, 2009.
- ISO/IEC/IEEE 24765:2010(E), "Systems and software engineering Vocabulary," First Edition, December 15, 2010.
- LWP 13620, "Managing Information Technology Assets"

3 Definitions and Acronyms

3.1 Definitions

- **Baseline.** A specification or product (e.g., project plan, maintenance and operations [M&O] plan, requirements, or design) that has been formally reviewed and agreed upon, that thereafter serves as the basis for use and further development, and that can be changed only by using an approved change control process. [ASME NQA-1-2008 with the NQA-1a-2009 addenda edited]
- **Validation.** Confirmation, through the provision of objective evidence (e.g., acceptance test), that the requirements for a specific intended use or application have been fulfilled. [ISO/IEC/IEEE 24765:2010(E) edited]
- **Verification.**
  - The process of evaluating a system or component to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase.
  - Formal proof of program correctness (e.g., requirements, design, implementation reviews, system tests). [ISO/IEC/IEEE 24765:2010(E) edited]

3.2 Acronyms

API Application Programming Interfaces

ANL Argonne National Laboratory

ARMA Auto-Regressive Moving Average

DOE Department of Energy

FMI Functional Mock-up Interface

FMU Functional Mock-up Unit

HERON Heuristic Energy Resource Optimization Network

IES Integrated Energy Systems

INL Idaho National Laboratory

NHES Nuclear-Renewable Hybrid Energy Systems

IT Information Technology

ORNL Oak Ridge National Laboratory

M&O Maintenance and Operations

NQA Nuclear Quality Assurance

POSIX Portable Operating System Interface

QA Quality Assurance

RAVEN Risk Analysis and Virtual ENviroment

SDD System Design Description

TEAL Tool for Economic Analysis

TRANSFORM Transient Simulation Framework of Reconfigurable Modules

XML eXtensible Markup Language

4 Pre-test Instructions/Environment/Setup

The test of the requirements are performed automatically through the CIS (Continuous Integration System) for each CR (Change Request). The tests are performed on each supported Operative System

5 FORCE:SYSTEM REQUIREMENTS

5.1 Requirements Traceability Matrix

This section contains all of the requirements, requirements' description, and requirement test cases. The requirement tests are automatically tested for each CR (Change Request) by the CIS (Continuous Integration System).

5.1.1 Minimum Requirements

Requirment ID	**Requirment Description**	**Test(s)**
R-M-1	Dymola 2020x or higher	1)K. Frick, A. Alfonsi, C. Rabiti, "HYBRID User Manual", INL/MIS-20-60624
R-M-2	Visual Studio 2017 or higher with associated 64-bit Intel Compiler	1)K. Frick, A. Alfonsi, C. Rabiti, "HYBRID User Manual", INL/MIS-20-60624
R-M-3	Python 3 or higher to be able to execute RAVEN-based workflows	1)K. Frick, A. Alfonsi, C. Rabiti, "HYBRID User Manual", INL/MIS-20-60624

Minimum Requirements


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