Executive Summary

Modeling and simulation

- More efficient simulation of large models with sparse structure, e.g. electrical transmission lines, up to 100x faster.
- New user interface for analyzing events helps find simulation bottlenecks and prepare models for real-time simulation.
- Flexible and natural handling of units on input, allowing expressions such as “47 pF” to be entered directly. Dymola detects unit and prefix to apply appropriate scaling.

New Modelica libraries

- Fluid Power – hydraulic systems
- Electric Power Systems – AC and DC including high-frequency AC
- Hydrogen – fuel cell applications
- ClaRa Plus – advanced power plants
- Fluid Dynamics – coarse grid CFD simulation of cabins and buildings
- Testing – build test models and create reference results
Sparse solvers for large-scale simulation

- Improved efficient simulation of large models with sparse structure
  - Typically models with spatial distribution, e.g. electrical transmission lines
- Used by numeric solver to handle large number of states
- Dymola suggest use of sparse solver
  - Automatic estimate during translation

Analyzing the event log

- New user interface for analyzing events
  - Plot summary of time and state events over time
  - List of all events in time order
  - Most frequent event expressions highlighted
  - Search and highlight every occurrence of an event expression (with wildcards)
  - Shows event iterations to find consistent state
- Helps find simulation bottlenecks and prepare models for real-time simulation
Analyzing numeric integration

- Further improvements to understand numeric integrator behavior for difficult models
- Detailed analysis of individual states
  - Error contribution at every simulation step
- Better understanding of types of events
  - Rejected steps due to integrator error estimate
  - State or step events
  - Integrator order

Functional Mockup Interface

- Further extended support for
  - canSerializeFMUState [FMI2]
  - providesDirectionalDerivative [FMI2]
  - canInterpolateInputs
  - maxOutputDerivativeOrder
- Export model image with an FMU
  - Icon or diagram image
- Use model image when importing FMU into Dymola
Modelica 2.x

- Support for Modelica 2 in Dymola discontinued
  - Modelica 3.0 was standardized in September 2007
  - Modelica Standard Library 3.0 was introduced on March 1, 2008
  - Modelica 2 traces its origins back to 2004
- Neither editing nor simulation possible anymore
  - Recommend conversion and validation using Dymola 2018
  - Best practices for converting model libraries from Modelica 2 to Modelica 3 are available in a Dymola newsletter

Platform support

- Dymola 32-bit application discontinued
- Simulation code for both 32- and 64-bit can be generated
- Support for modern 64-bit Linux systems
- Improved interoperability
  - Visual Studio 2015, Intel Parallel Studio XE 2017 and GCC 5.3
  - MATLAB R2012a – R2017a
Dymola newsletters

- Starting a series of newsletters
  - Mainly to highlight interesting features
  - Compact two-page format emphasizes readability over completeness

- Currently published
  - Dymola Sparse Solvers for Large-Scale Simulations
  - Model Analysis Using the Event Log in Dymola
  - Analyzing Numeric Integration
  - Migrating from Modelica 2 to Modelica 3

New Modelica libraries
New libraries in Dymola 2018 FD01

- Fluid Power
  - Hydraulic systems
- Electric Power Systems
  - Electric power systems for e.g. aircraft
- Hydrogen
  - For modeling of PEM fuel cell stacks and fuel cell system
- ClaRa Plus
  - For advanced power plant simulation
- Fluid Dynamics
  - Estimate the human comfort within an air-conditioned zone
- Fluid Dissipation
  - Convective heat transfer and pressure loss
- Testing
  - Build test models and compare to reference results

Fluid Power library

- Used for modeling hydraulic systems
- Compatible with VeSyMA family and Modelica Standard Library
  - Uses standard MSL media, extensible
- Both high-level components and fundamental building blocks
- Flexible parameterization
  - Geometry or nominal flow and pressure
- Fast and efficient simulation
Electric Power Systems library

- Used for modeling electric power systems
  - AC and DC, including high-frequency AC
  - Typical application: electrical aircraft systems
  - Generation, conversion, control, storage, consumption
- Both architectural and functional modeling
- Efficient simulation of high-frequency AC using Phasor methodology

Hydrogen library

- Modeling of PEM fuel cell stacks and fuel cell systems
  - For any fuel cell using pure hydrogen and moist air
  - Several membrane models and auxiliary components
- Medium models are based on the fluid model interface of the Modelica Standard Library
ClaRa Plus library

- For advanced power plant simulation
- Typical applications
  - Coal fired power plants
  - Gas turbine units
  - Combined cycle power plants
  - Heat recovery steam generators
  - Cogeneration power plants
  - Organic Rankine Cycles
  - Grid emergency failures
  - Island grid operation

Fluid Dynamics library

- Coarse grid CFD simulation for system simulations
  - Coarse grid geometry (cubic cells)
  - Realistic flow conditions using Navier-Stokes equations
  - Radiation exchange by using view
- Design and optimization of air conditioning systems
  - Automotive
  - Buildings
Testing library

▶ Build test cases, create reference results and run the tests inside Dymola
  ▶ Detect unwanted side effects of model changes
  ▶ Detect early by running regular tests

▶ Multiple blocks for the comparison of signals to reference values and trajectories

▶ Existing examples and test models can easily be converted to a test case
  ▶ Extend from model under test
  ▶ Provide a reference
  ▶ Connect signals of interest to comparison blocks

Overview of available libraries

▶ Battery Library
▶ Brushless DC Drives Library
▶ ClaRa Plus
▶ Cooling Library
▶ Electric Power Systems
▶ Electrified Power Train Library
▶ Flexible Bodies Library
▶ Flight Dynamics Library
▶ Fluid Dynamics
▶ Fluid Power
▶ Human Comfort Library
▶ HVAC Library
▶ Hydrogen
▶ Thermal Systems
▶ VeSyMA Engines
▶ VeSyMA Powertrains
▶ VeSyMA Suspension Library
▶ Wind Power Library