

MATLAB Energy Conference

- Modeling Drilling Dynamics with Simulink

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Agenda

- Intro Simulink
- Simulink Projects and version control
- MATLAB Function Block and Mask
- Custom Library in Library Browser
- Variant Subsystem
- Resources

Simulink Projects

The screenshot displays the Simulink Project Management environment for a project named "Open source drilling dynamics model". The main window is the "Dependency Analyzer", which provides a visual overview of the project's file dependencies.

File List (Left Pane):

Name	Status	Classification
.gitattributes	✓	
.gitignore	✓	
combined_model_NOE_No_Motor.slx	✓	Design
combined_model_NOE_No_Motor.slxc	✓	
Drilling_dynamics_library.mdl	✓	Design
Function_Surface_Tracking_Model_MDOF.m	✓	Design
Main_Code_Surface_Tracking_Model_MDOF.m	✓	Design
Parameters_Initiatization_NOE_No_Motor.mlx	✓	Design
topdrive_ROP.mat	✓	Design
topdrive_RPM.mat	✓	Design

Legend (Center Pane):

- █ MATLAB Code (3 of 3)
- █ Simulink Models and Libraries (1 of 1)
- █ Data (2 of 2)
- █ Other Files (10 of 10)

Dependency Graph (Right Pane):

```

graph TD
    Root[combined_model_..._slx] --> Topdrive_ROP[topdrive_ROP.mat]
    Root --> Topdrive_RPM[topdrive_RPM.mat]
    Root --> Dia_TJoint[Dia_TJoint]
    Root --> Dia_hole[Dia_hole]
    Root --> Dia_pipe[Dia_pipe]
    Root --> E[E]
    Root --> G[G]
    Root --> ID_DP[ID_DP]
    Root --> L_DP[L_DP]
    Root --> M_DP[M_DP]
    Root --> OD_DP[OD_DP]
    Root --> Main_Code_Surface[Main_Code_Surface_..._m]
    Root --> Parameters_Initat[Parameters_Initat_..._mlx]
    Main_Code_Surface --> Function_Surface[Function_Surface_..._m]
  
```

Properties (Far Right Pane):

- Details:** Project: Open source drilling dyn...; Root: ...d motor integrated System
- Products:** MATLAB, Simulink
- Problems:** Missing file (9); [How to fix problems](#)

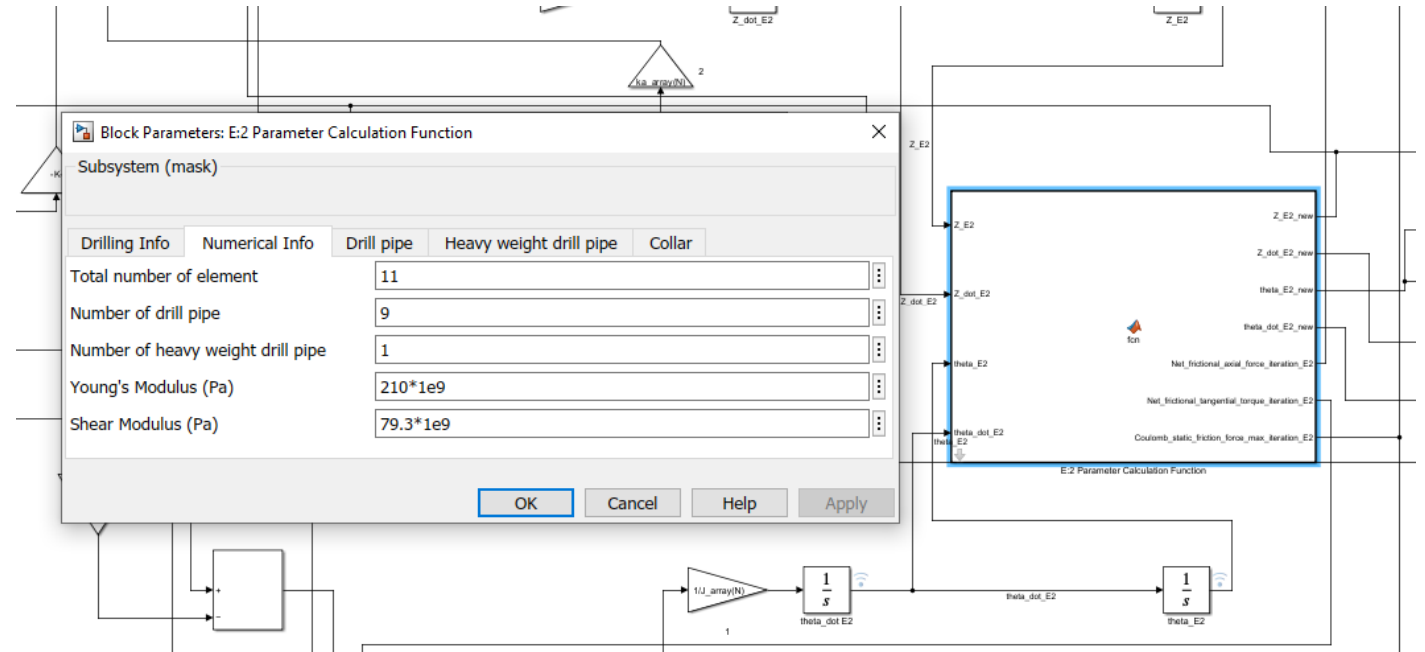
https://www.mathworks.com/help/simulink/project-management.html?searchHighlight=projects&s_tid=srchtitle_projects_1

MATLAB Function and Masking Subsystem

```

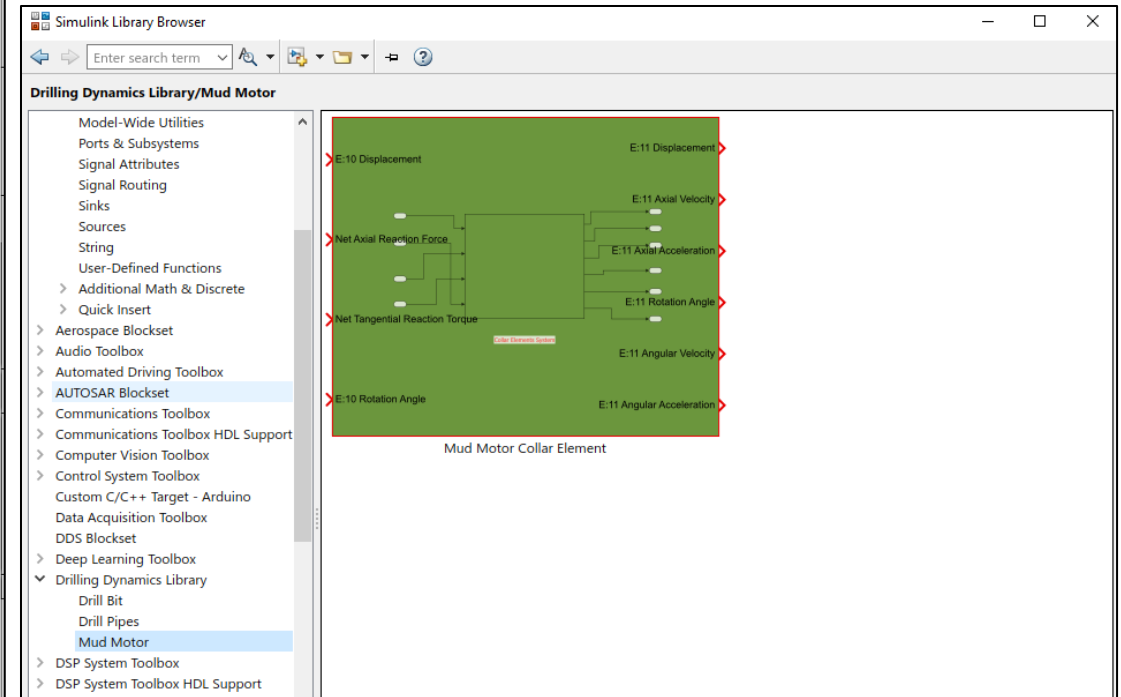
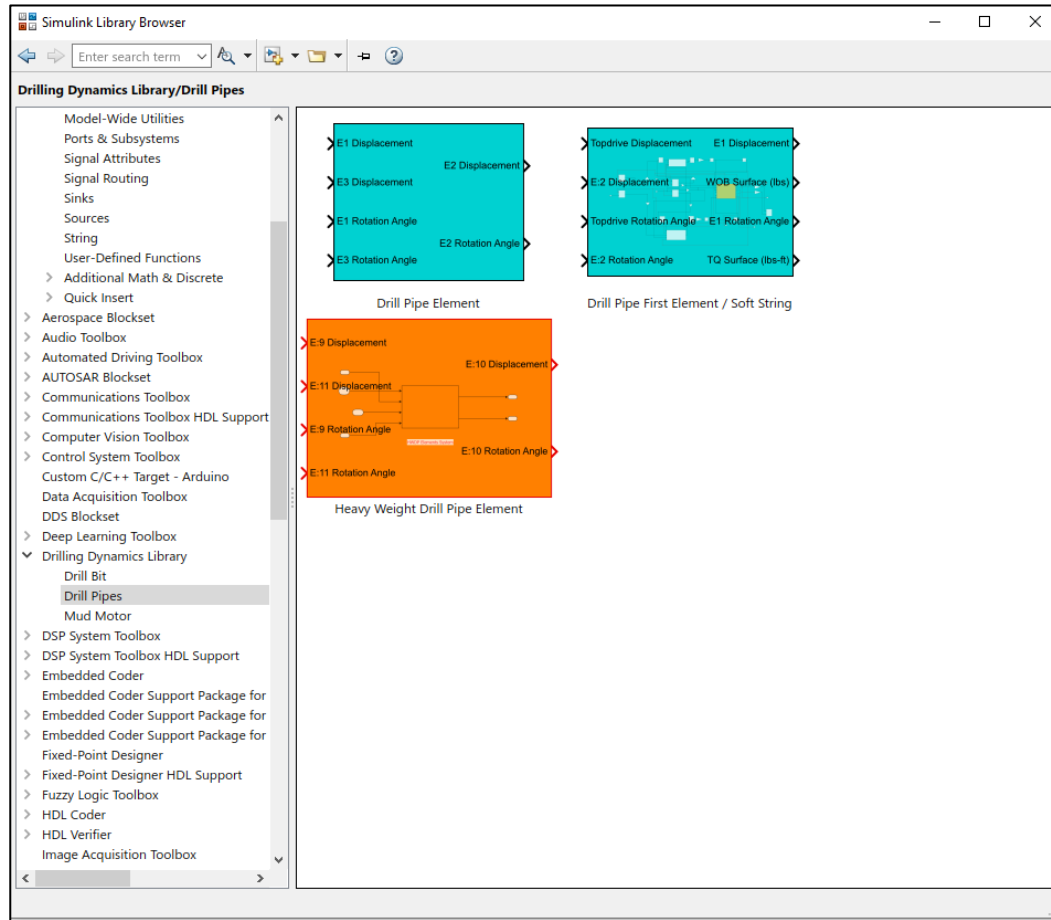
1 function [Z_E2_new, Z_dot_E2_new, theta_E2_new, theta_dot_E2_new,
2
3 %% Model Units for evaluation purpose are set in SI system but fo
4
5 %% Validation Analysis for Qatar's NFQ18-05 - 17.5" BHA07 2896 m
6
7 % NOE = 11;
8 % N_DP = 9;
9 % N_HWDP = 1;
10 N_Collar = NOE - (N_DP + N_HWDP);
11
12 %% Steady-State parameters values corresponding to CCS = 2 (ksi)
13
14 ROP_ss = 27;
15 RPM_ss = 120;
16
17
18 %% Defining bit-diameter, rock-strength and coefficient of frictio
19
20 % Trip length is utilized to run the simulation in Tripping mode
21
22 % Dia_hole = 17.5;
23 % Dia_pipe = 5.5;
24 % Dia_TJoint = 7;
25 Dia_pipe_equivalent = ( (27 * Dia_pipe) + (3 * Dia_TJoint) ) / 30;
26 pipe_axial_velocity_multiplier = ( (Dia_pipe).^2 ) / ( (Dia_hole).^2 );
27
28

```



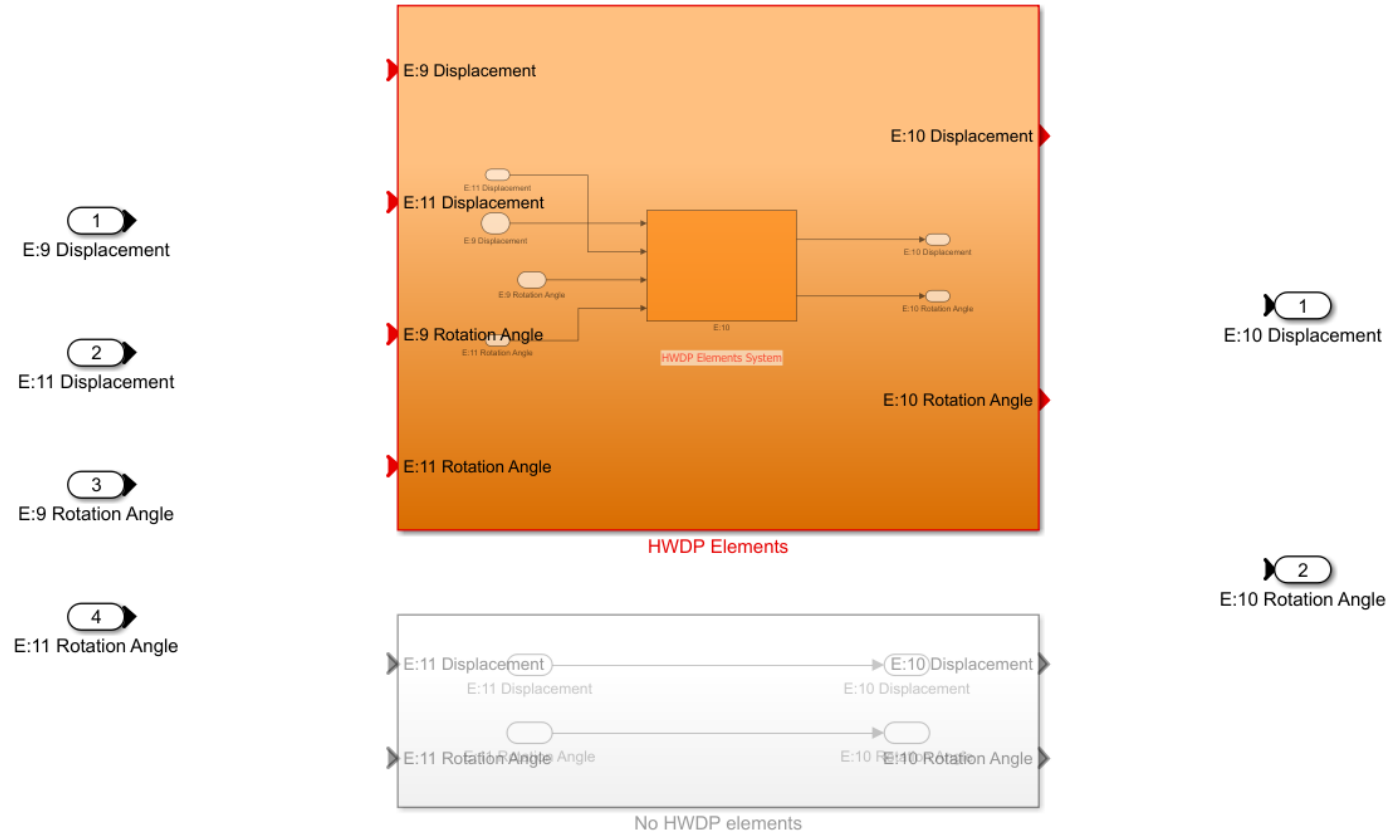
https://www.mathworks.com/help/simulink/slref/matlabfunction.html?searchHighlight=MATLAB%20Function&s_tid=srchtitle_MATLAB%20Function_4
https://www.mathworks.com/help/simulink/block-masks.html?searchHighlight=block%20mask&s_tid=srchtitle_block%20mask_1

Custom Library for Frequently Used Function Blocks



https://www.mathworks.com/help/simulink/libraries.html?searchHighlight=custom%20library&s_tid=srchtitle_custom%20library_1

Variant Subsystem for Switching Subsystems



https://www.mathworks.com/help/simulink/variant-systems.html?searchHighlight=variant%20system&s_tid=srchtitle_variant%20system_1

Resources

- Self-pace free learning material
 - MATLAB Onramp
 - Simulink Onramp
 - https://matlabacademy.mathworks.com/?s_tid=gn_trg_cosp#getting-started
- MathWorks Training
 - https://www.mathworks.com/services/training.html?s_tid=gn_trg_copc#popular
- Industry team
 - Sales: Keith Droge (kdroge@mathworks.com), Tyler Dauer (tdauer@mathworks.com), Jordan Burrow (jburrow@mathworks.com)
 - Industry Marketing: Samvith Rao (samvithr@mathworks.com)
- Application engineer, Consulting service