LIGO

Updates on the QUAD State Space Matlab model

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The Matlab Model manual can be found at G1401132.

Send questions or comments to Edgard (edgard [at] stanford.edu)

Overview

- The Matlab model generates a first-principles state space model of a QUAD suspension.

- It is a very powerful tool for both commissioning and control design for the suspensions.

- It has been used by the collaboration for years.

- It now has a new interfacing structure, both for use and modification.

Some Features

LIGO

```
>> generate_QUAD_Model_Production()
You have chosen to construct the default QUAD Model
```
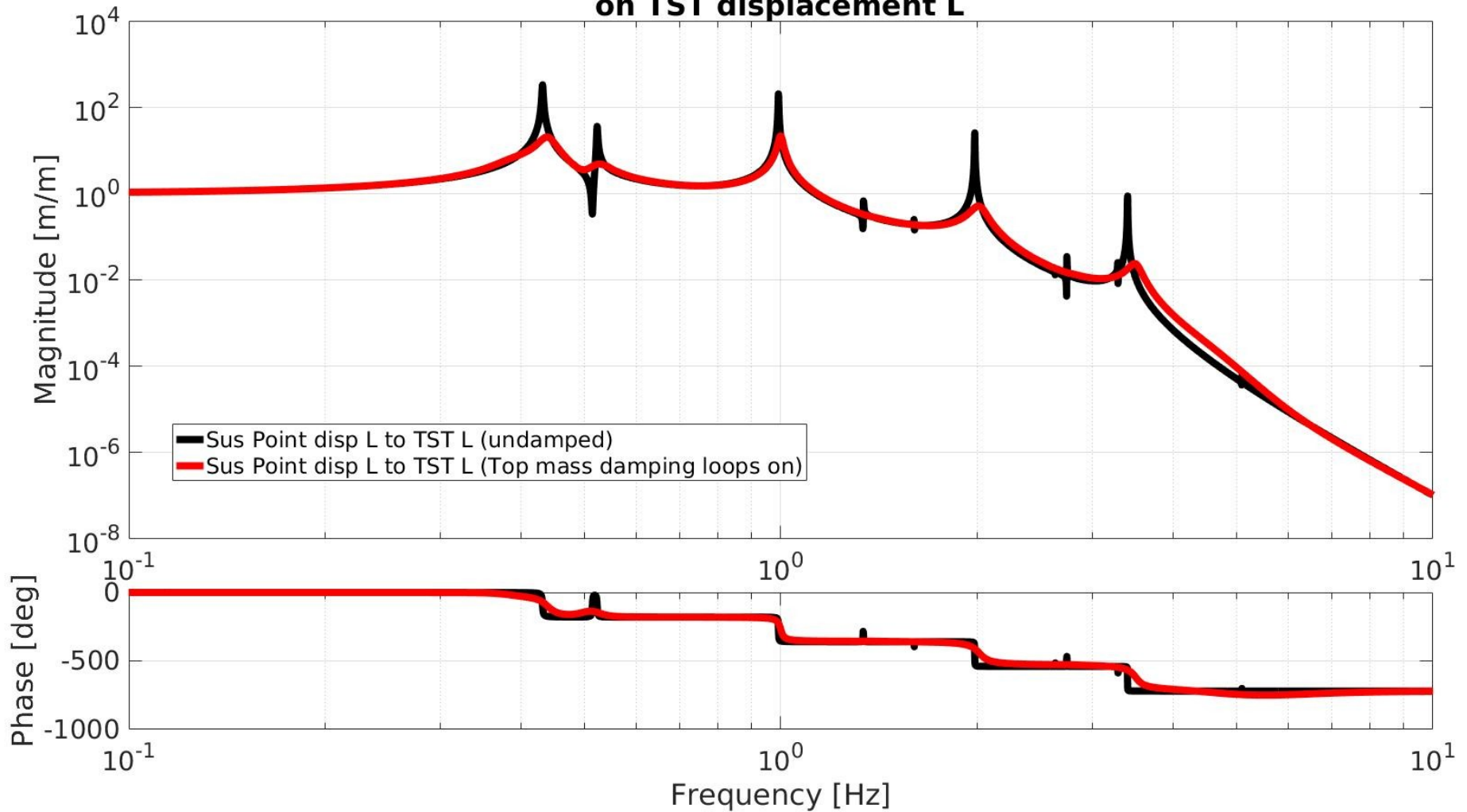

Example drive on differrent stages to TST displacement L
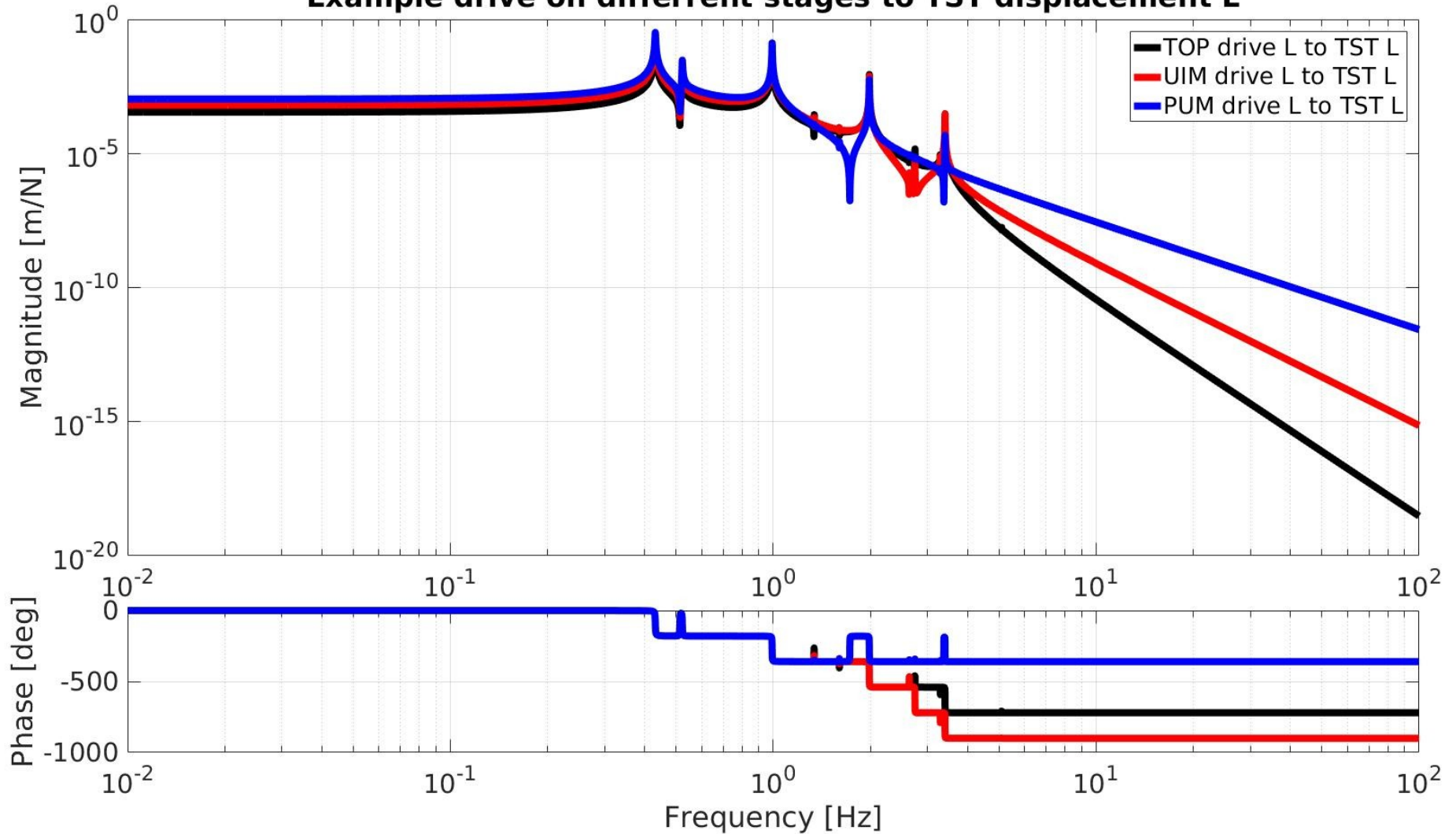
Some Features

```
options.topMassDamping = 'default';
quadModel2=generate_QUAD_Model_Production(options);
```
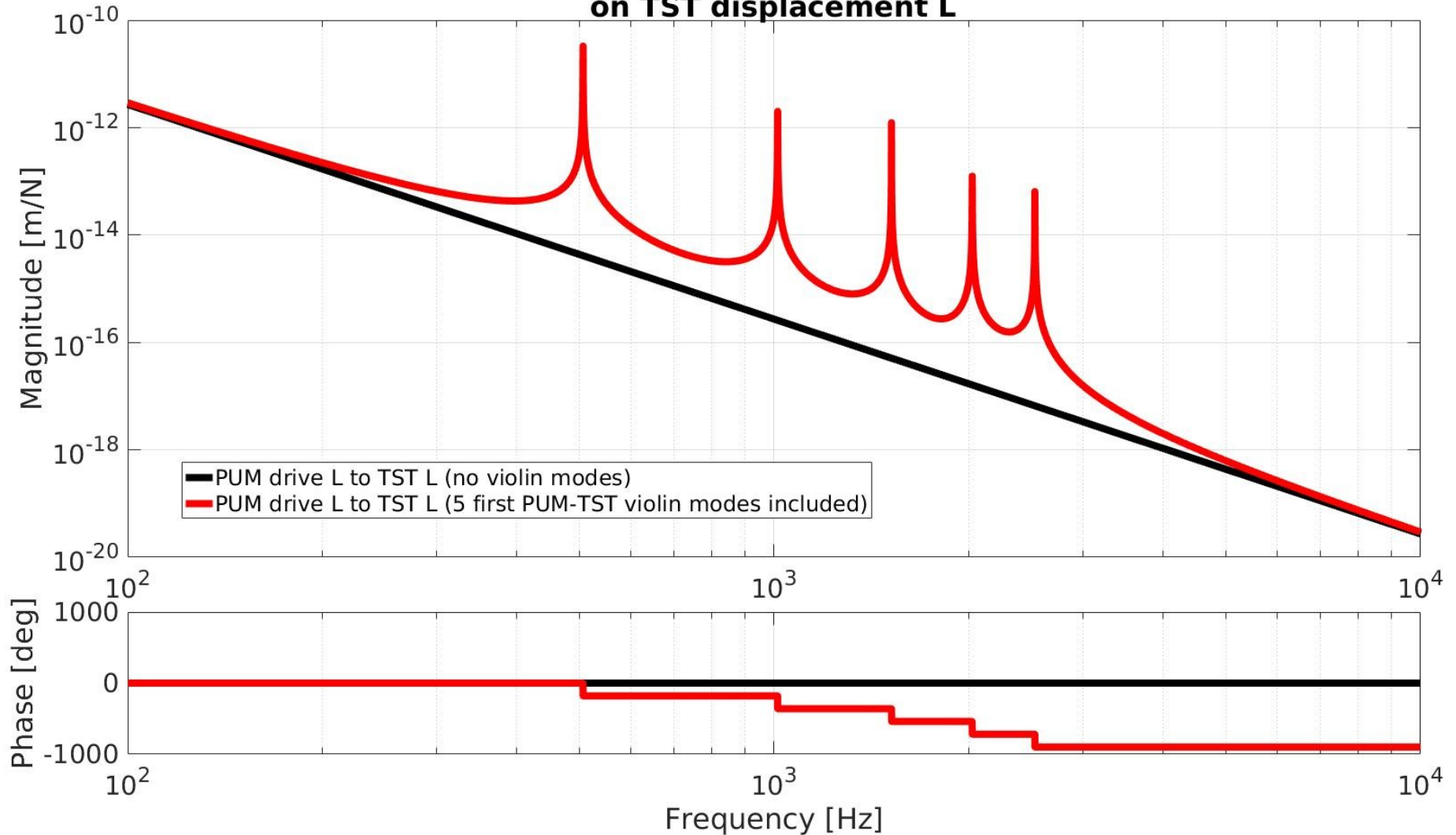

Example effect of the top mass damping Loops on TST displacement L

Some Features

*For a complete feature list, check G1401132.

SVN location

The model files are found in

…/SusSVN/sus/trunk/QUAD/Common/MatlabTools/QuadModel_Production/

The model is compiled with the function:

generate_QUAD_Model_Production.m

The new interfacing script for the model is:

QUAD_Model_input_options_template.m

*More information can be found at G1401132.

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New Interface

- The interfacing script lays all the modifiable options:

-
```
options.importFromSites=true;



options.startTime='1185883218';



options.IFO='H1';



options.Optic='ITMX';
```

New Interface

- It doubles down as an user manual for the model options:

-

```
%% Damping filter options
% Can import damping from the sites or define your own damping. Importing from the sites overrides anything you have defined on your own.
%Supports any kind of filter format: zpk, ss, tf, etc...The format is converted to state space for computation, since state space permits more precise computation.

%Request damping from the sites
options.importFromSites=true;    % Request to import the filters directly from the sites
                                 % [logical] / Anything different from 'false' triggers the reading from the sites
                                 % Importing from the sites sets the damping state to exactly how it is at the sites, overriding any other damping defined below
                                 % Importing from the sites includes M0 and/or R0 (aka top mass) and OL damping at L1 (aka UIM) and L2 (aka PUM).
                                 % If damping is running elsewhere at the site, it will not be included.

options.startTime='1185883218'; % Start GPS time for the request
                                 % [1xj char] The GPS time has to be specified as a string
                                 % 'live' or 'now' can be used to read within 5 min of the current time

options.IFO='H1';               % Interferometer to be read.
                                 % [1xj char] / 'h1' for Hanford. 'l1' for Livingston

options.Optic='ITMX';           % Suspension to be read at the site
                                 % [1xj char] / supported options: 'etmx','itmx','etmy','itmy'
```
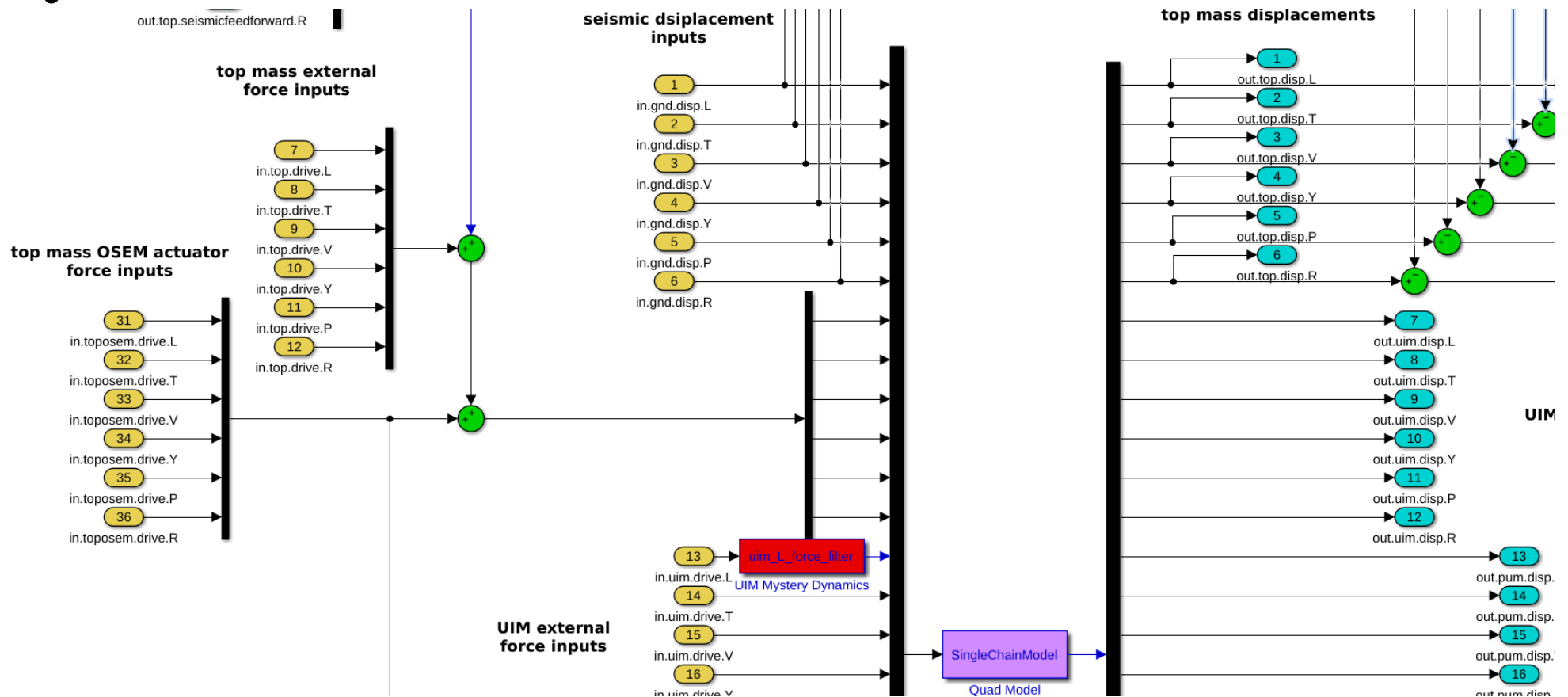
*Excerpt from: `c)QUAD_Model_input_options_template.m`

Adding Features

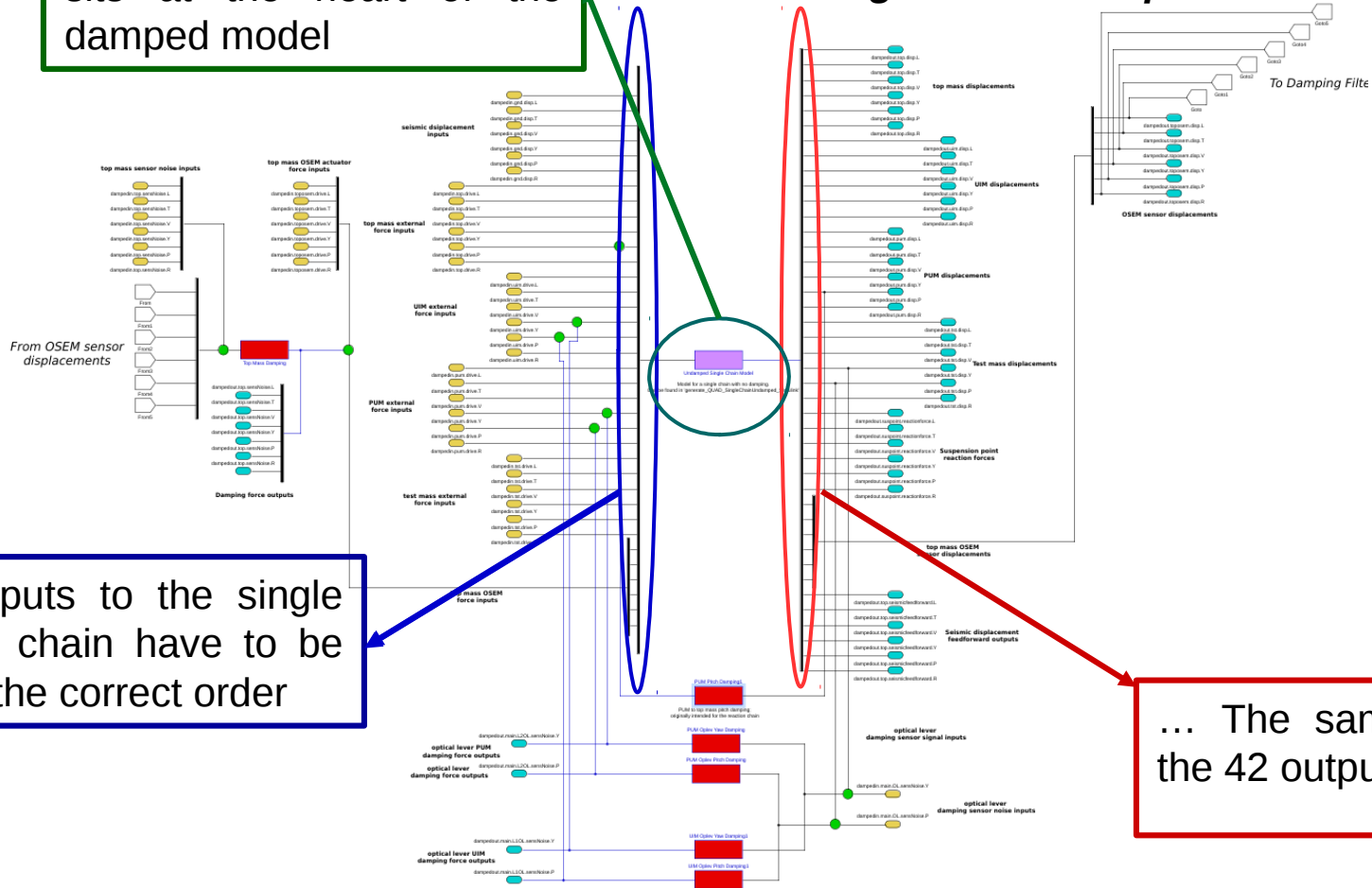- All the models are compiled with Simulink diagrams:

-

*Excerpt from: `c)Generate_QUAD_SingleChainUndamped.slx`

Adding Features

The single undamped chain sits at the heart of the damped model

Single Chain damped model

The 36 inputs to the single undamped chain have to be fed to it in the correct order

… The same applies for the 42 outputs.

*More information can be found at G1401132.

Future Directions

- Continue to maintain the model. Adding features as needed.

- Bring the other Matlab suspension models to a similar state to this one.

*The Matlab Model manual can be found at G1401132.

*Send questions or comments to Edgard (edgard [at] stanford.edu)