

PEET

Pointing Error Engineering Tool



PEET is a software tool that supports engineers in the set-up and calculation of error budgets to estimate the impact of error sources on the total system performance and a figure of merit. It is suitable for performance budgets in all engineering domains – there is no restriction to pointing applications.

PEET is designed as a toolbox for MATLAB and provides a dedicated graphical user interface to quickly create and modify the error signal flow via drag & drop. This allows an increased transparency on models and assumptions compared to purely tabular (spreadsheet) budgets.

Key Features

General

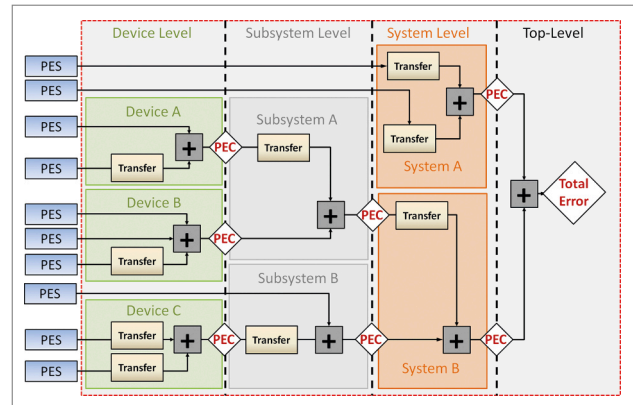
- 1-axis and 3-axis budgets based on standardized rules from ECCS (ECSS-ST-60-10C) and the methodology described in the ESA Pointing Error Engineering Handbook (ESSB-HB-E-003)
- Unitary interface format to exchange, share and combine budgets
- Frequency domain approach for error signal transfer and sample-based approach for statistical error source properties allow fast evaluation compared to time-domain based Monte Carlo approach, thus the tool is well-suited for trade-off studies
- Free-of-charge for space organizations within ESA member states

Performance Requirement Definition

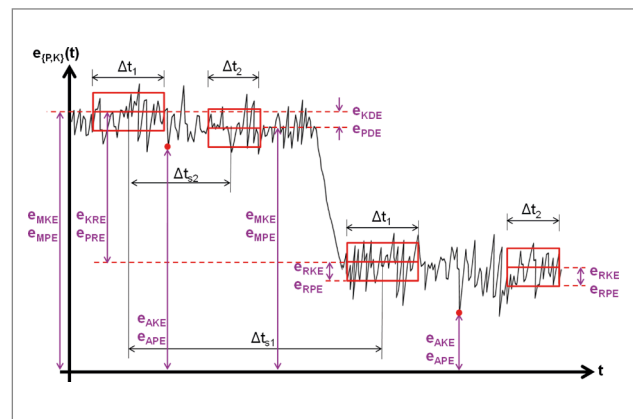
- Statistical requirements with given level of confidence
- Spectral budgets based on power spectral densities
- Explicit consideration of absolute errors and errors defined within and between certain time windows based on standardized metrics
- Requirements on time-constant, time-random and total error contributions traceable via user-defined ID

“Error System” Definition

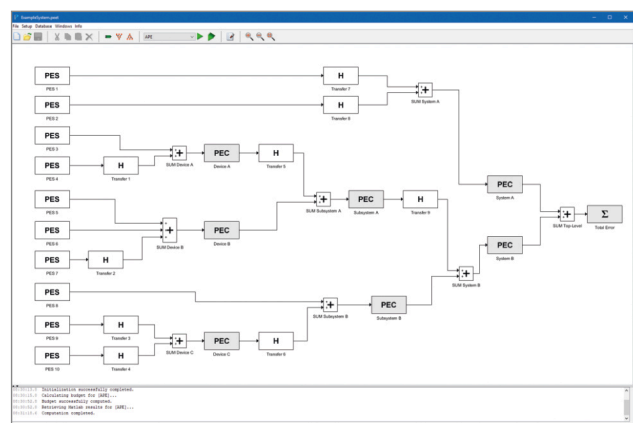
- Error sources based on typical (or user-defined) probability distributions or power spectral density functions
- Customizable correlation between temporal and ensemble properties of error sources



Generic budgeting problem: from error sources to system error



Absolute and time-windowed errors in ECSS standard



The System Editor: creating the error signal routing

- Static or dynamic (LTI) system transfer models
- Unit package with automatic unit conversion and consistency checks

Error Evaluation

- “Simplified” and “advanced” level of confidence evaluation based on mean and standard deviation or probability density functions
- Automatic consideration of correlation and impact of time-windowed error in the summation
- Standardized summation rules avoid typical discussions on how to sum error contributions

Interfaces

- Data import from MS Excel or MATLAB workspace
- Customizable MS Excel reports
- Figure export in MATLAB compatible format (.fig)
- Script-based execution using MATLAB scripts simplifies integration into tool chains

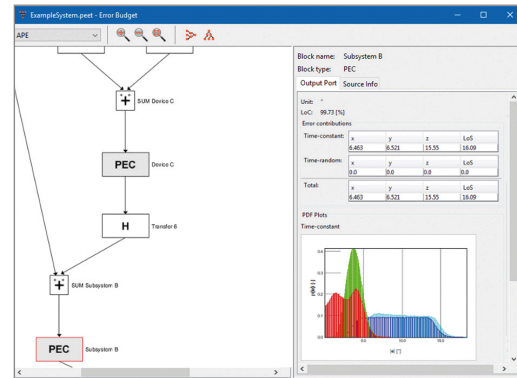
Visualization

- Error signal analysis and requirement compliance in dedicated tree view that represent the system/requirement structure
- Various plot types for probability densities, probability function, correlation and power spectra

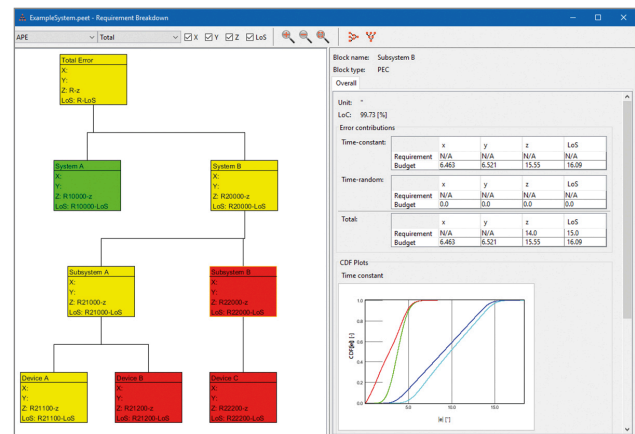
Software Requirements

- Windows 10/11, Linux CentOS or higher
- MATLAB 2011b or higher (64 bit versions only)
- MATLAB Control System Toolbox
- Any C-language compiler configured for MATLAB mex (freely available)

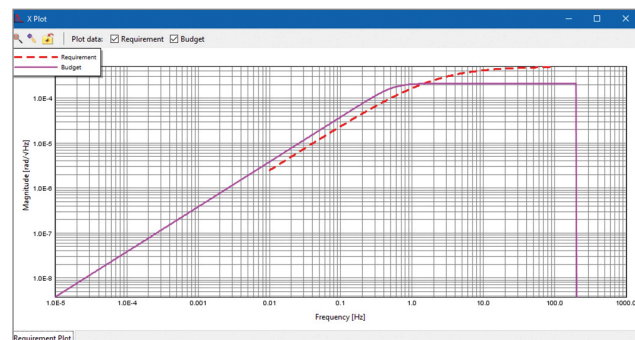
- MATLAB is a registered trademark of The MathWorks, Inc.
- Control System Toolbox is a trademark of The MathWorks, Inc.



The Budget Tree View: analysing error signal properties (exemplary for a statistical “3-Sigma” budget)



The Breakdown Tree View: checking compliance with requirements



Exemplary: spectral budget versus requirement function