

RELIABILITY ANALYSIS STUDENT PROJECT

Welcome to the Reliability Analysis Tool!
This tool helps you analyze electronic component reliability using Monte Carlo simulation and sensitivity analysis methods.

- i Checking environment setup...
- ✓ Python version: 3.14
 - ✓ Module 'numpy' found
 - ✓ Module 'pandas' found
 - ✓ Module 'matplotlib' found
 - ✓ Module 'math' found
 - ✓ Module 'openpyxl' found
 - ✓ File 'reliability_math.py' found
 - ✓ File 'task1_monte_carlo.py' found
 - ✓ File 'task2_sensitivity_analysis.py' found

RELIABILITY ANALYSIS - MAIN MENU

Please select an option:

- 1. Calculate Block Reliability (Deterministic)
- 2. Task 1: Monte Carlo Simulation
- 3. Task 2: Sensitivity Analysis
- 4. Run Both Tasks (Sequential)
- 5. Test Environment Setup
- 6. Help & Documentation
- 0. Exit

Your choice: 1

BLOCK RELIABILITY CALCULATION

i Please enter the path to your Excel data file:
(Press ENTER for default placement. Example: Reliability_Total.xlsx or ./data/Reliability_Total.xlsx)
File path: Reliability_Total.xlsx

BLOCK RELIABILITY CALCULATION

i Please enter the path to your Excel data file:
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File path: Reliability_Total.xlsx
✓ Excel file validated: Reliability_Total.xlsx
i Loading Excel file to list available blocks...

Available blocks (hierarchical structure):

- /Project Architecture/Control/ (55 total components)
- 1. /Project Architecture/Control/ (10 components)
 - 2. /Project Architecture/Control/MCU_A/ (15 components)
 - 3. /Project Architecture/Control/MCU_B/ (15 components)
 - 4. /Project Architecture/Control/MCU_C/ (15 components)
- /Project Architecture/Power/ (307 total components)
- 5. /Project Architecture/Power/ (11 components)
 - 6. /Project Architecture/Power/Battery Charger/ (62 components)
 - 7. /Project Architecture/Power/Deploy/Boost/ (39 components)
 - 8. /Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B1/ (9 components)
 - 9. /Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B2/ (9 components)
 - 10. /Project Architecture/Power/Deploy/Buck/ (17 components)
 - 11. /Project Architecture/Power/Deploy/Buck/TRIGGER_LOGIC_B3/ (9 components)
 - 12. /Project Architecture/Power/Ideal Diode Battery/ (5 components)

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- 9. /Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B2/ (9 components)
- 10. /Project Architecture/Power/Deploy/Buck/ (17 components)
- 11. /Project Architecture/Power/Deploy/Buck/TRIGGER_LOGIC_B3/ (9 components)
- 12. /Project Architecture/Power/Ideal Diode Battery/ (5 components)
- 13. /Project Architecture/Power/Ideal Diode Satellite/ (5 components)
- 14. /Project Architecture/Power/LDO_3v3_bat/ (20 components)
- 15. /Project Architecture/Power/LDO_3v3_sat/ (16 components)
- 16. /Project Architecture/Power/Passivate Arbitration/ (9 components)
- 17. /Project Architecture/Power/Passivate Memory/ (16 components)
- 18. /Project Architecture/Power/Protection Battery/ (17 components)
- 19. /Project Architecture/Power/Protection Satellite 24V/ (17 components)
- 20. /Project Architecture/Power/System On Logic/ (3 components)
- 21. /Project Architecture/Power/System On Logic/Off Arbitration/ (9 components)
- 22. /Project Architecture/Power/System On Logic/On Arbitration/ (9 components)
- 23. /Project Architecture/Power/System On Logic/On Memory/ (16 components)
- 24. /Project Architecture/Power/Unlatch Arbitration/ (9 components)

/Project Architecture/Trigger IDD/ (9 total components)
25. /Project Architecture/Trigger IDD/ (9 components)

=====

i
Total: 25 blocks with 378 components
i
Enter block number or exact block name:
Tip: Start with a top-level block and use sub-block processing!

Block:

Process sub-blocks? (y/n): y

i Starting reliability calculation...
i Loading data from Reliability_Total.xlsx...

- ✓ Found 20 matching sheets:
- /Project Architecture/Power/
 - /Project Architecture/Power/Battery Charger/
 - /Project Architecture/Power/Deploy/Boost/
 - /Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B1/
 - /Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B2/
 - /Project Architecture/Power/Deploy/Buck/
 - /Project Architecture/Power/Deploy/Buck/TRIGGER_LOGIC_B3/
 - /Project Architecture/Power/Ideal Diode Battery/
 - /Project Architecture/Power/Ideal Diode Satellite/
 - /Project Architecture/Power/LDO_3v3_bat/
 - /Project Architecture/Power/LDO_3v3_sat/
 - /Project Architecture/Power/Passivate Arbitration/
 - /Project Architecture/Power/Passivate Memory/
 - /Project Architecture/Power/Protection Battery/
 - /Project Architecture/Power/Protection Satellite 24V/
 - /Project Architecture/Power/System On Logic/
 - /Project Architecture/Power/System On Logic/Off Arbitration/
 - /Project Architecture/Power/System On Logic/On Arbitration/
 - /Project Architecture/Power/System On Logic/On Memory/
 - /Project Architecture/Power/Unlatch Arbitration/

Processing 20 blocks...
✓ All blocks processed

RELIABILITY ANALYSIS SUMMARY

Block	Comp	Lambda (FPH)	Reliability
/Project Architecture/Power/	11	1.911244e-07	0.991664
/Project Architecture/Power/Battery Charger/	62	1.196892e-06	0.948927
/Project Architecture/Power/Deploy/Boost/	39	5.414992e-07	0.976561
/Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B1/	9	5.369573e-08	0.997651
/Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B2/	9	5.369573e-08	0.997651
/Project Architecture/Power/Deploy/Buck/	17	2.749730e-07	0.988028
/Project Architecture/Power/Deploy/Buck/TRIGGER_LOGIC_B3/	9	5.369573e-08	0.997651
/Project Architecture/Power/Ideal Diode Battery/	5	1.325062e-07	0.994213
/Project Architecture/Power/Ideal Diode Satellite/	5	1.325062e-07	0.994213
/Project Architecture/Power/LDO_3v3_bat/	20	1.112744e-06	0.952430
/Project Architecture/Power/LDO_3v3_sat/	16	5.848157e-07	0.974710
/Project Architecture/Power/Passivate Arbitration/	9	5.369573e-08	0.997651
/Project Architecture/Power/Passivate Memory/	16	2.673851e-07	0.988357
/Project Architecture/Power/Protection Battery/	17	1.452035e-07	0.993660
/Project Architecture/Power/Protection Satellite 24V/	17	1.452035e-07	0.993660
/Project Architecture/Power/System On Logic/	3	4.467804e-08	0.998045
/Project Architecture/Power/System On Logic/Off Arbitration/	9	5.369573e-08	0.997651
/Project Architecture/Power/System On Logic/On Arbitration/	9	5.369573e-08	0.997651
/Project Architecture/Power/System On Logic/On Memory/	16	2.673851e-07	0.988357
/Project Architecture/Power/Unlatch Arbitration/	9	5.369573e-08	0.997651
SYSTEM TOTAL (Series)	307	5.412787e-06	0.788928

Mission Parameters:
Duration: 43,800 hours (5.00 years)
Cycles per year: 5,256
Temperature cycle amplitude: 3°C

Interpretation:
Green (R > 0.99) - Excellent reliability
Cyan (R > 0.95) - Good reliability
Yellow (R > 0.90) - Acceptable reliability
Red (R ≤ 0.90) - Poor reliability (needs attention)

✓
Calculation completed successfully!