36489

High Temperature Receiver Design and Analysis Package (srlife)

1. Impact

Designing durable metallic receivers for prolonged operation above 800° C is challenging and represents a major risk in implementing next-gen CSP systems. Better methods for estimating receiver life and computer-aided design optimization could reduce costs and risk.

2. Project Goal

Provide system designers with a rapid (<1 minute per design), accurate means to estimate the structural life of a receiver that can be embedded into an existing software stack and used to optimize/tune receiver designs.

3. Method(s)

Leverage existing software (Heliosim, SolarPILOT, NEML, etc.) and existing material data, where available. Provide a validated, open-source software tool.

4. Outcome(s)

Complete version of tool available as open source software at https://github.com/Argonne-National-Laboratory/srlife. Includes material data for 316H, 740H, 800H, A230, and A617 with A282 forthcoming.

5. Conclusion/Risks

Approximate analysis with good heuristics is nearly as accurate as full 3D simulation but two orders of magnitude faster. Predictions are only as good as the available material data, which is sparse for some materials. Life estimates can be very sensitive to metal temperatures – reducing by 10° C can increase receiver life by years!

6. Team

ANL: modeling and tool development
INL: A282 test data
ANU: system developer feedback and testing

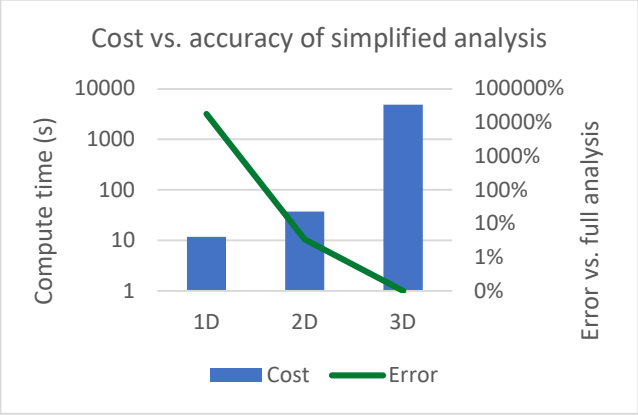

Figure 1. Computational heuristics, like dimensionality reduction here, enables rapid life estimation meeting project goals

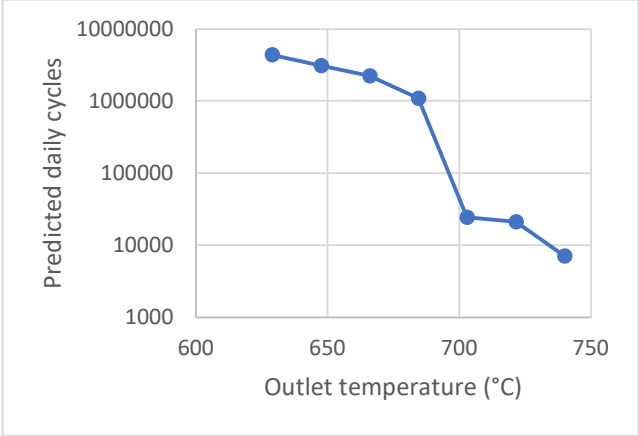

Figure 2. Alloy 740H receiver life prediction versus outlet temperature