Stone Lake Analytics

Look Inside the Machine

Stone Lake Analytics is a consultancy available for long- or short-term engagement on difficult structural analysis (FEA) problems. Our specialty is in multi-component machines, with movement and contact.

We have broad experience in physical testing in parallel with analytical work – we learned "to eat our own dog food", correlating results and improving study methods.

A Stone Lake client can expect:
- Assistance in formulating closed-end questions and goals for a study
- Expert solid modeling to support the project
- Rigorous study setup, without shortcuts
- Quick turnaround of key results
- Ongoing communication as we learn together about the application
- Formal communication with detailed final reports and supporting documentation.

A Stone Lake client will be asked to provide:
- Best known background of the project including loading and physical interfaces
- Well-posed questions to be answered (typically yes/no or quantitative)
- Detailed 3D geometry (more detail is better – we will simplify if needed)
- Designated contact for quick communication.

Outlines of example studies are available at stonelakeanalytics.com. The contact form there can be used to initiate an inquiry. We look forward to learning about your challenges and digging for the information that you need.

Lead analyst Shawn Mahaney, MSME, has extensive experience with moving machines. In 25 years of work in automotive, heavy rail, material handling, and factory process applications he has dealt with issues in static structure, dynamic loads, casting quality, and hardware specification.

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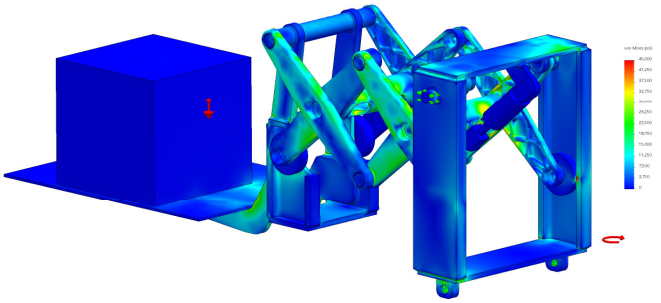
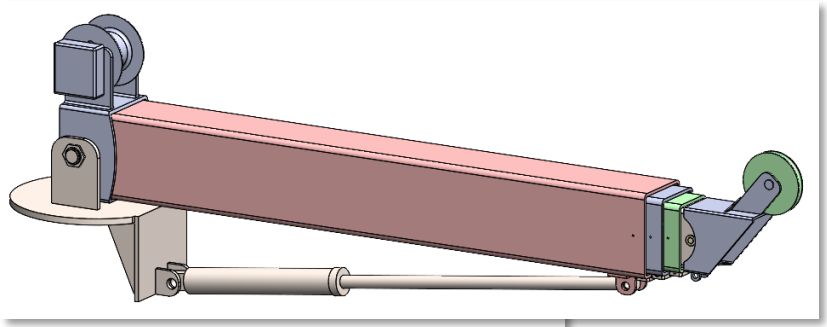
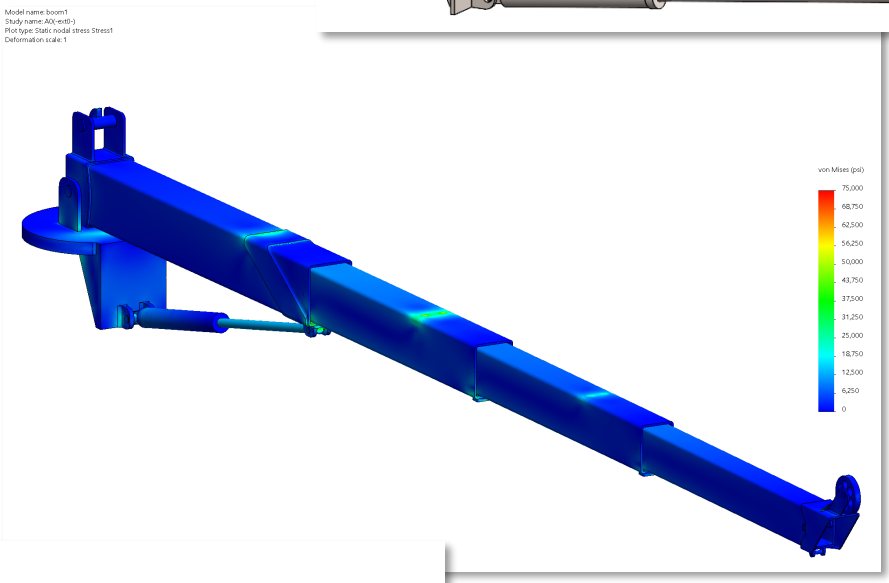


Crane Boom

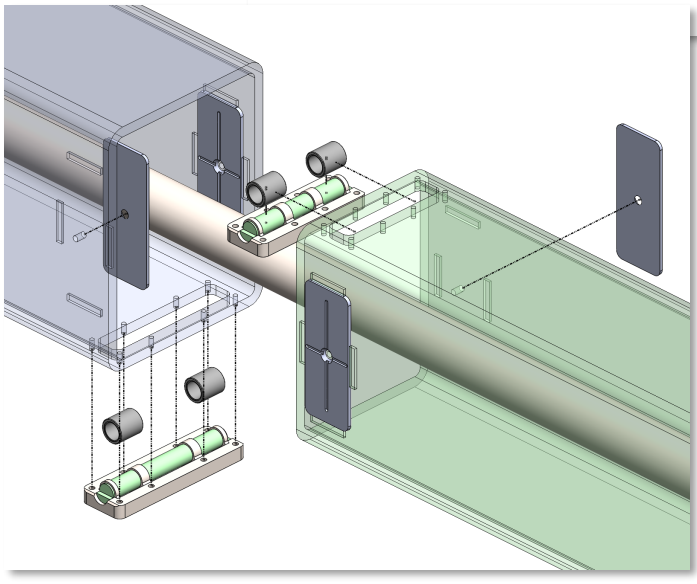
Stress and Force Tabulation of Nested Sections

A proposed low-cost crane boom was studied for feasibility and component sizing. The customer model was delivered in multiple overlaps (at constant extended length) and different elevations.

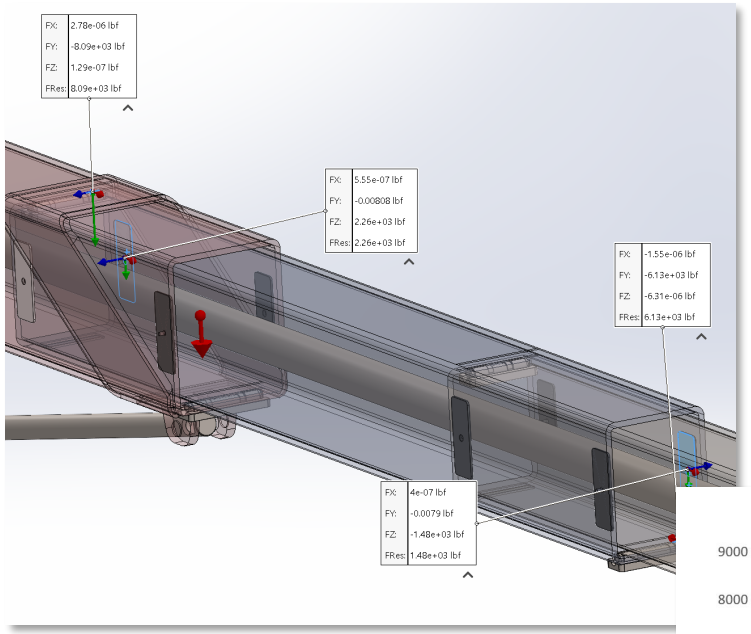




Studies began with conventional stress calculations. All parts were simulated in free contact.

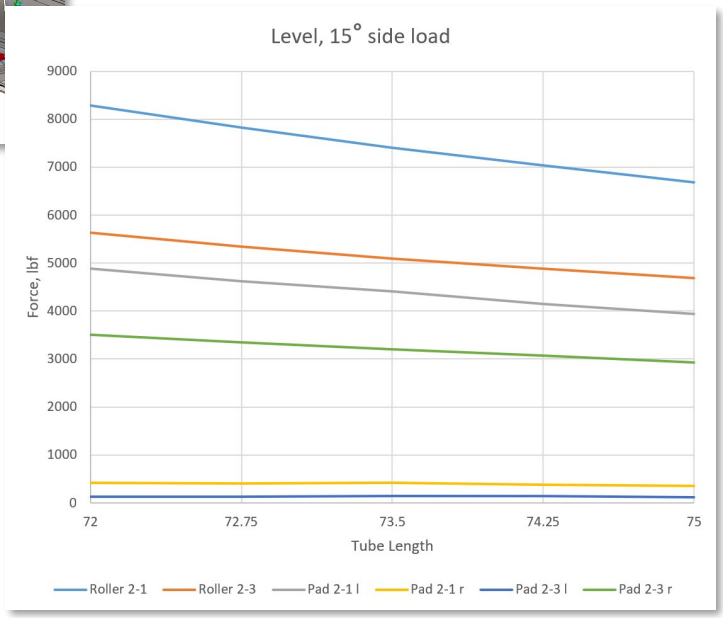


Also of interest to the customer was forces on the rollers and wear pads which transfer loads between boom sections. Necessary detail for these components was preserved for FEA studies.



For 14 different geometry/loading combinations, inter-component forces were reported for all load-transfer parts.

Graphical presentation of selected results demonstrated design trends and confirmed expected performance..



A key final deliverable was the complete tabulation of inter-component forces. Values in excess of part ratings are quickly identified and categorized.

STUDIES						ROLLERS												PADS											
						2 to 1		1 to 2		3 to 2		2 to 3		4 to 3		3 to 4		2 to 1		1 to 2		3 to 2		2 to 3		4 to 3		3 to 4	
study	load angle	cut length	overlap	lift angle	load (lb)	left	right	left	right	left	right	left	right	left	right	left	right	left	right	left	right	left	right	left	right	left	right	left	right
A0	0	72	20	0	1600	8090	8111	9194	9199	5136	5160	6127	6136	2499	2494	3377	3388	2257	2267	1974	1983	1792	1789	1479	1480	858	858	1096	1098
A1	0	72.75	21	0	1600	7626	7641	8729	8736	4820	4881	5827	5843	2351	2353	3236	3240	2146	2146	1950	1955	1699	1691	1419	1421	810	808	1047	1048
A2	0	73.5	22	0	1600	7210	7229	8321	8322	4580	4593	5564	5581	2219	2230	3113	3110	2071	2082	1948	1932	1607	1613	1364	1365	767	764	1026	1021
A3	0	74.25	23	0	1600	6839	6844	7941	7951	4335	4355	5337	5319	2110	2104	2992	2996	1934	1939	1925	1924	1509	1509	1294	1299	735	735	981	988
A4	0	75	24	0	1600	6478	6510	7593	7607	4135	4111	5109	5115	2005	1993	2887	2885	1851	1849	1906	1902	1449	1438	1242	1242	698	697	935	938
B0	15	72	20	0	1600	8285	7365	8502	9267	5259	4688	5637	5310	2548	2276	3055	3480	4889	418	7879	5061	3516	646	134	3504	1778	335	379	2276
B1	15	72.75	21	0	1600	7826	6920	8040	8828	4943	4426	5344	5927	2408	2136	2920	3335	4615	407	7932	4781	3312	597	137	3346	1672	308	362	2172
B2	15	73.5	22	0	1600	7410	6539	7639	8439	4710	4151	5099	5668	2285	2013	2806	3205	4415	426	29	4563	3141	590	144	3205	1568	286	363	2093
B3	15	74.25	23	0	1600	7039	6178	7276	8075	4474	3920	4890	5413	2168	1902	2693	3091	4151	378	86	4430	2956	534	138	3068	1506	289	357	2036
B4	15	75	24	0	1600	6687	5864	6949	7740	4255	3712	4686	5192	2063	1800	2594	2984	3935	362	156	4298	2820	519	122	2925	1429	275	333	1944
C25	0	72	20	25	1732	7795	7826	8854	8873	4971	4970	5909	5943	2413	2407	3271	3274	2232	2228	1964	1971	1771	1770	1446	1445	830	830	1065	1063
C40	0	72	20	40	1990	7670	7709	8665	8700	5004	4999	5905	5912	2543	2534	3366	3374	2181	2181	1951	1948	1758	1765	1433	1435	891	894	1085	1083
C55	0	72	20	55	2550	6788	6805	7685	7702	4347	4347	5179	5181	2072	2060	2843	2842	1952	1951	1695	1683	1550	1548	1282	1283	726	728	940	939
C55-4	0	75	24	55	2550	5561	5577	6474	6478	3593	3595	4435	4433	1758	1756	2353	2541	1602	1600	1630	1635	1269	1274	1089	1091	617	617	825	828

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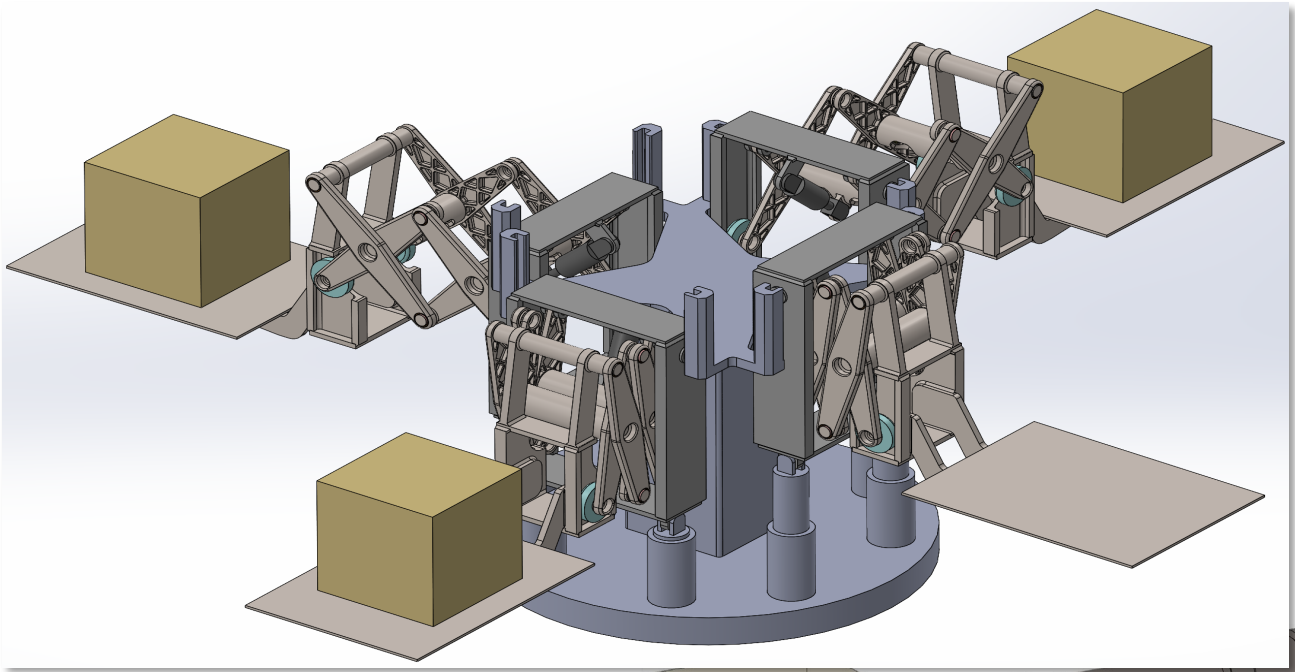
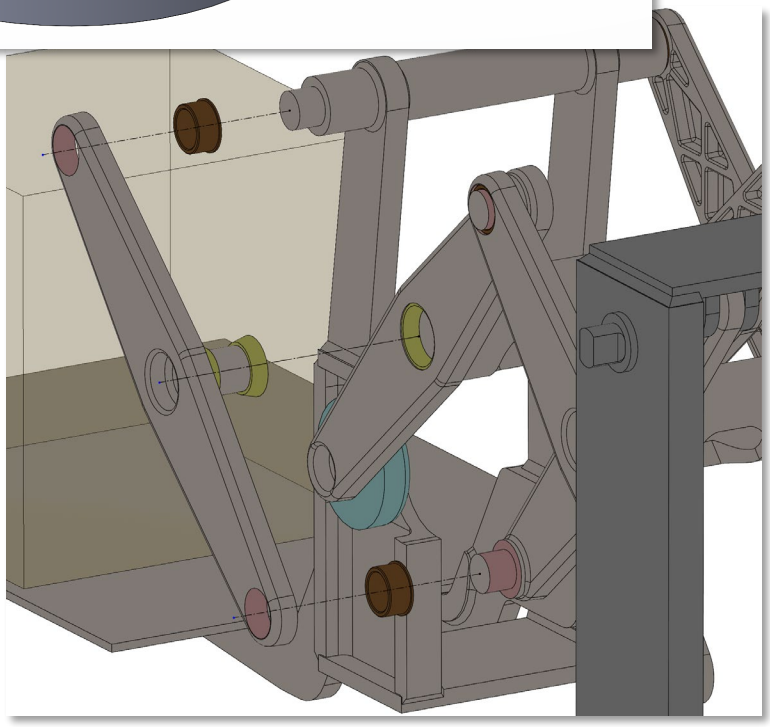
Reach Handler

Stress in Pantograph Under Inertial Loading

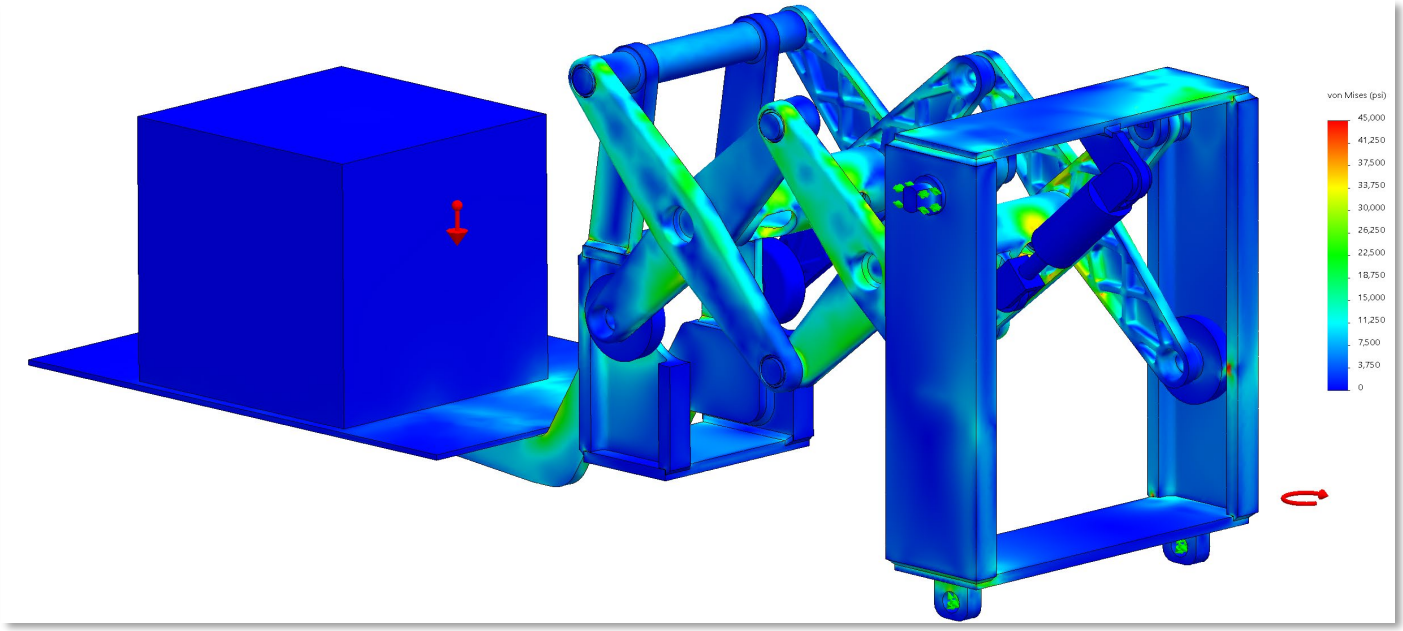
A production cell has need of a load handling system which can lift and manipulate heavy objects. Four handlers are to be mounted on a carousel, with independent elevation and reach.



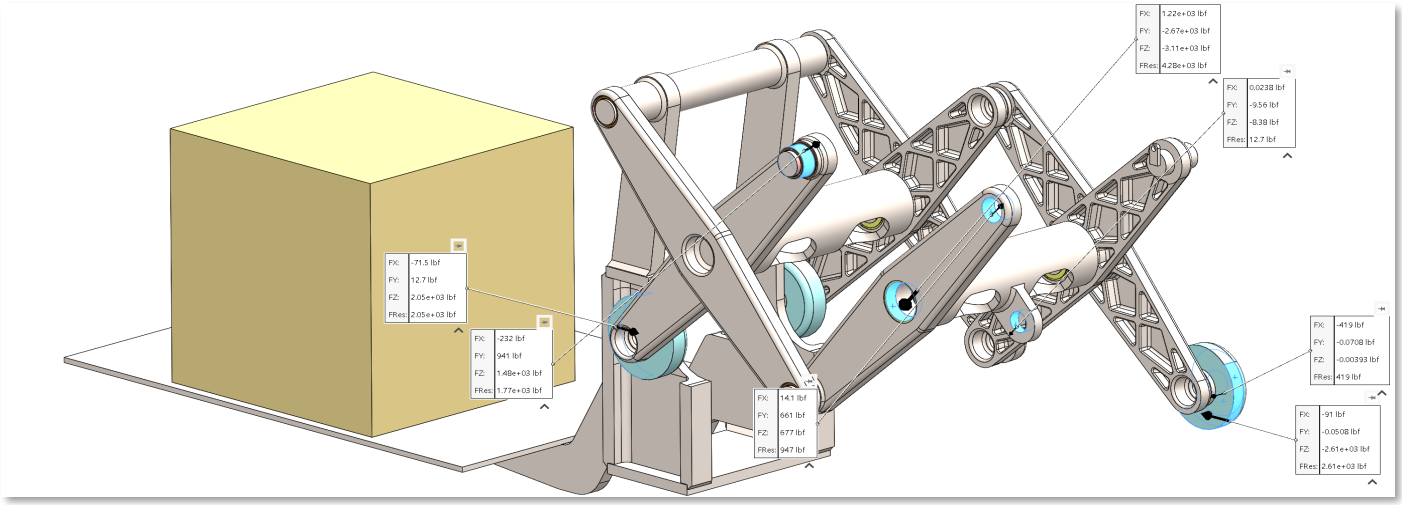
The assembly includes bushings at arm end joints and pairs of tapered roller bearings at center joints. These were included in the simulation model and run in full contact so that reaction forces could be listed for these hardware components.



Loading is by gravity vector and rotational acceleration. A 1200 pound mass load block was in contact with the lift platform.



Geometric detail was retained sufficient to evaluate performance of the ribbed arm castings..



Reaction forces were taken for all bushings, bearings, and rollers. Data for sizing of lift and reach cylinders was also obtained.

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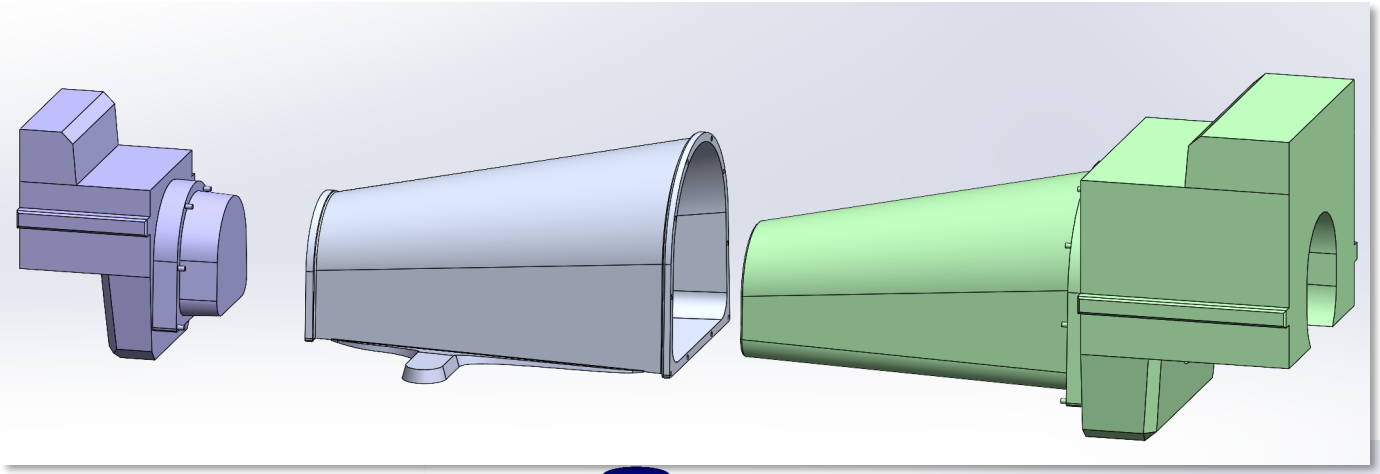
Casting Die

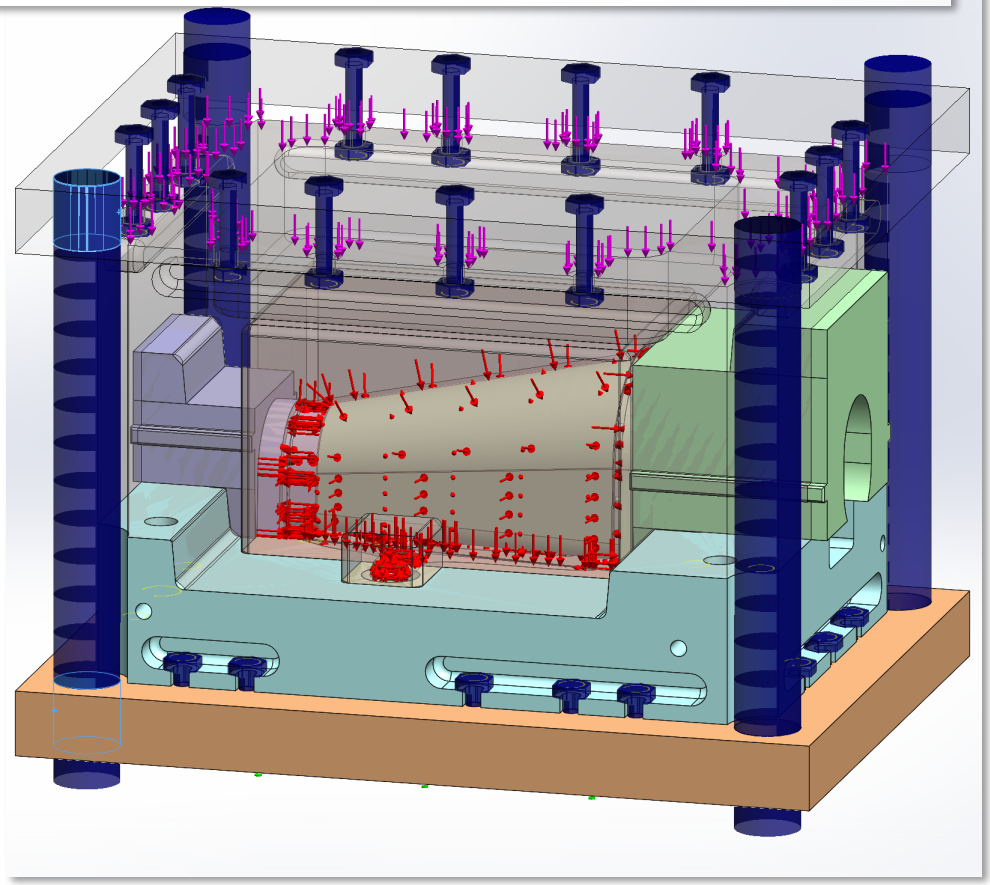
Stress in Die and Holders With Pressure and Interference

An aluminum bell housing is to be made in a high-pressure die cast process. The part requires two slides with cooling.

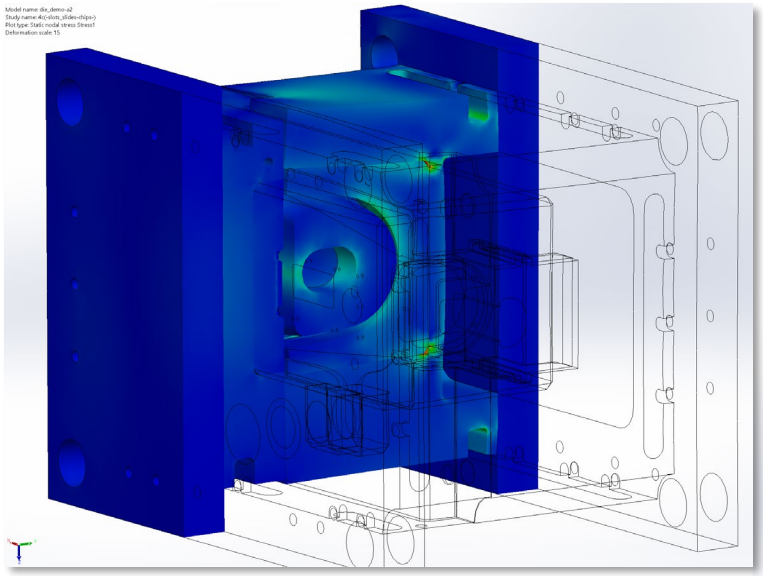


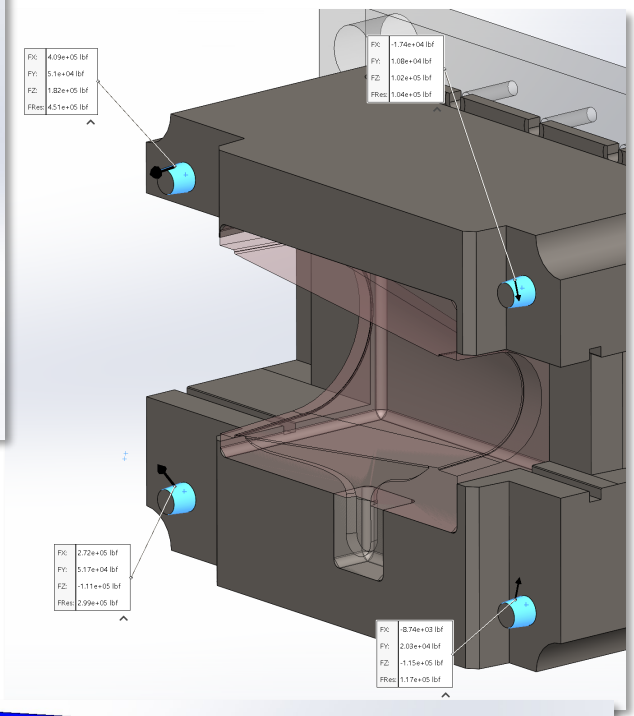
The complete die was modeled, including inserts, holder blocks, and simplified platens. Tie bars were modeled with virtual pin connectors. Platen T-bolts were modeled as bolt connectors, with pre-torque.

Loading was by fluid pressure on all wet surfaces and planned clamping force on the ejector side platen. This unstable setup can expose if machine size is not adequate.



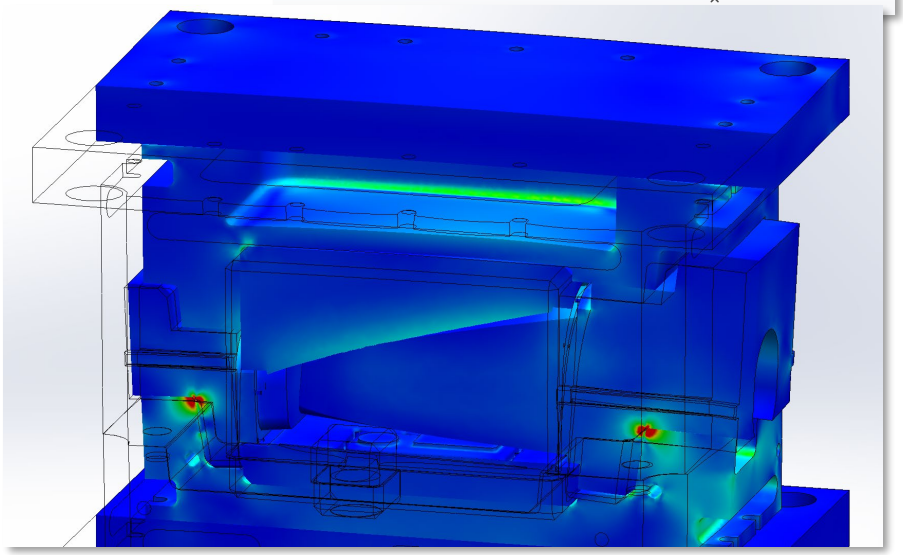
Early runs showed insufficient holder wall thickness around the deep sections of the part. Walls were thickened until stress and distortion were reasonable.





Reaction force reporting impacted position and sizing of inter-half locating pins.

Further studies included study of possible interference from thick flash at worst-case locations, loading the slide locks. Stress fields from these studies guided location of cooling lines.



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