

AFGROWN Release 5.3

Proposed Work

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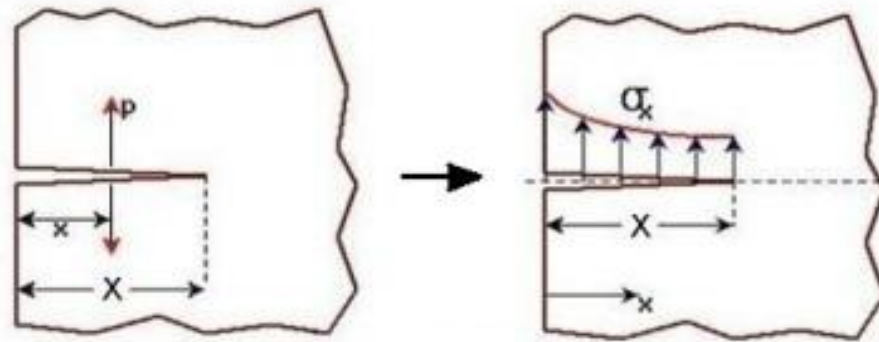
LexTech, Inc

Release 5.3

- New weight functions solutions (crack at hole, stress distribution in the c-direction for part through cracks)
- Using different material data as a function of spectrum parameter(s)
- Applying different material data as a function of crack dimension
- Ability to replicate Results from previous versions (back to Version 5.01)
- Option to save input file with retardation state data for later restart
- Undo-Redo
- New solution for a corner crack at the countersink knuckle (Jody Cronenberger)
- MSD solution(s)

Weight Function K-Solution

Current AFGROW Solution Developed by Prof. Greg Glinka,
University of Waterloo



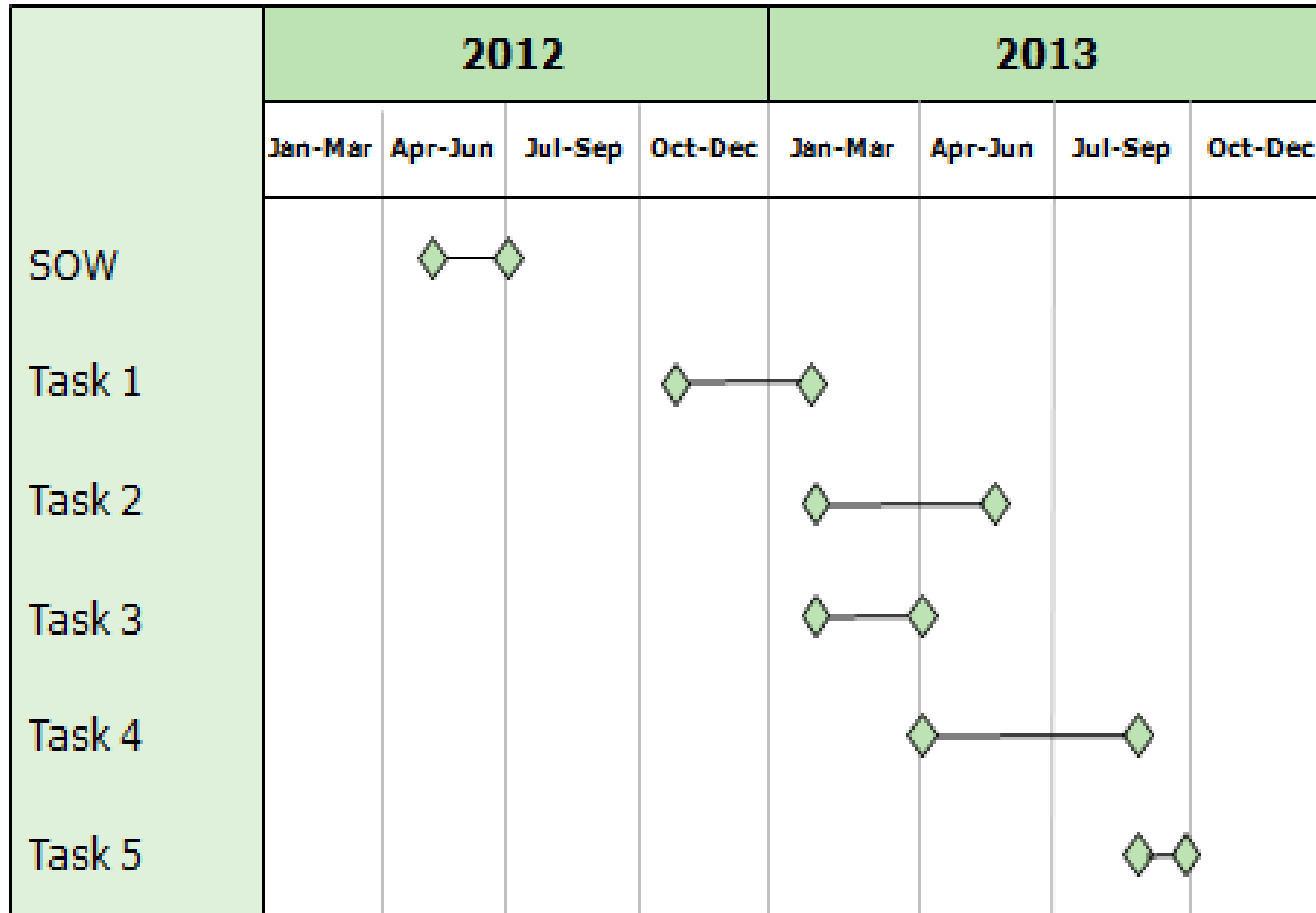
$$K = \int_0^X \sigma(x) m(x, X) dx$$

$$m(x, X) = \frac{2}{\sqrt{2\pi(X-x)}} \left[1 + M_1 \left(1 - \frac{x}{X}\right)^{\frac{1}{2}} + M_2 \left(1 - \frac{x}{X}\right) + M_3 \left(1 - \frac{x}{X}\right)^{\frac{3}{2}} \right]$$

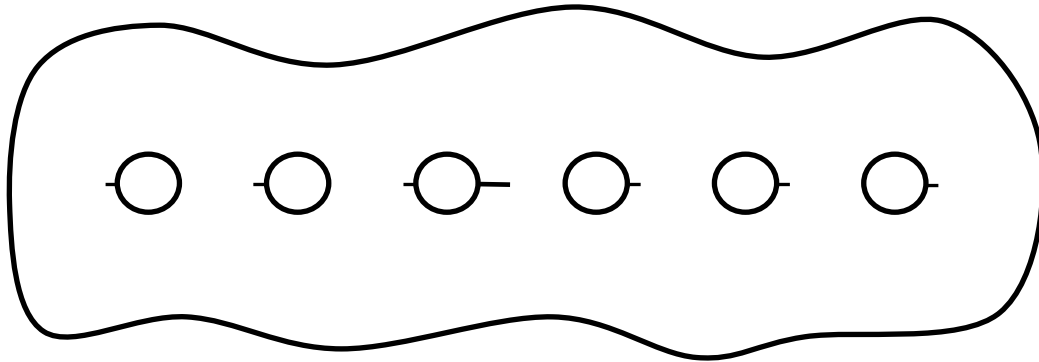
Updated Weight Function Solution Tasks

- An updated edge crack weight function with improved accuracy of parameters M_1 , M_2 and M_3 .
- An Extended range of validity for the weight function for a semi-elliptical crack with new parameters M_1 , M_2 and M_3 .
- A new weight function with extended range of validity and improved accuracy for a corner crack in a plate subjected to in-plane loading (stress varies along 'c' semi-axis of the quarter-elliptical crack).
- A new weight function for a corner crack in a plate subjected to out-of-plane loading (stress field changes along the 'a' semi-axis of the quarter-elliptical crack).
- A new weight Function for an edge crack in a plate with boundary conditions preventing in-plane rotation of the cracked edge (needed for modeling SIF for cracks emanating from internal notches/holes).
- A new weight function for an edge crack in a plate with boundary conditions preventing in-plane rotation of the plate edge opposite to the cracked edge (needed for modeling SIF for cracks emanating from side edge notches).

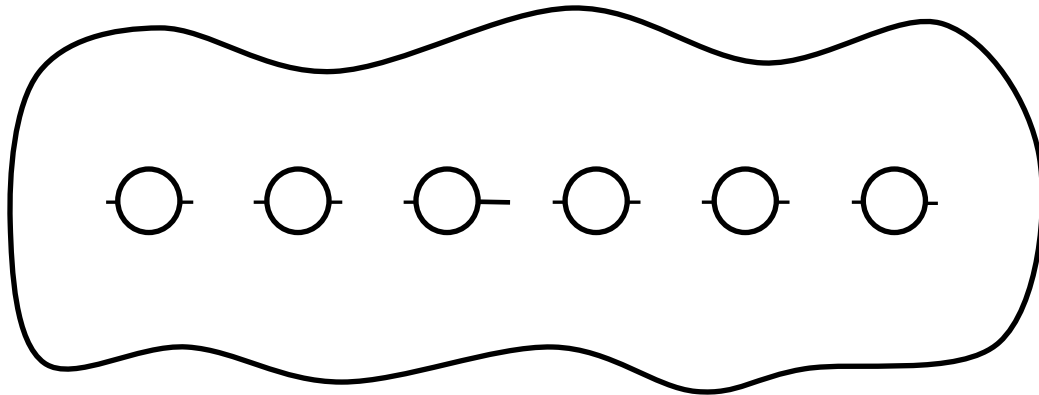
AFGROW Weight Function Upgrade Schedule



MSD Solution



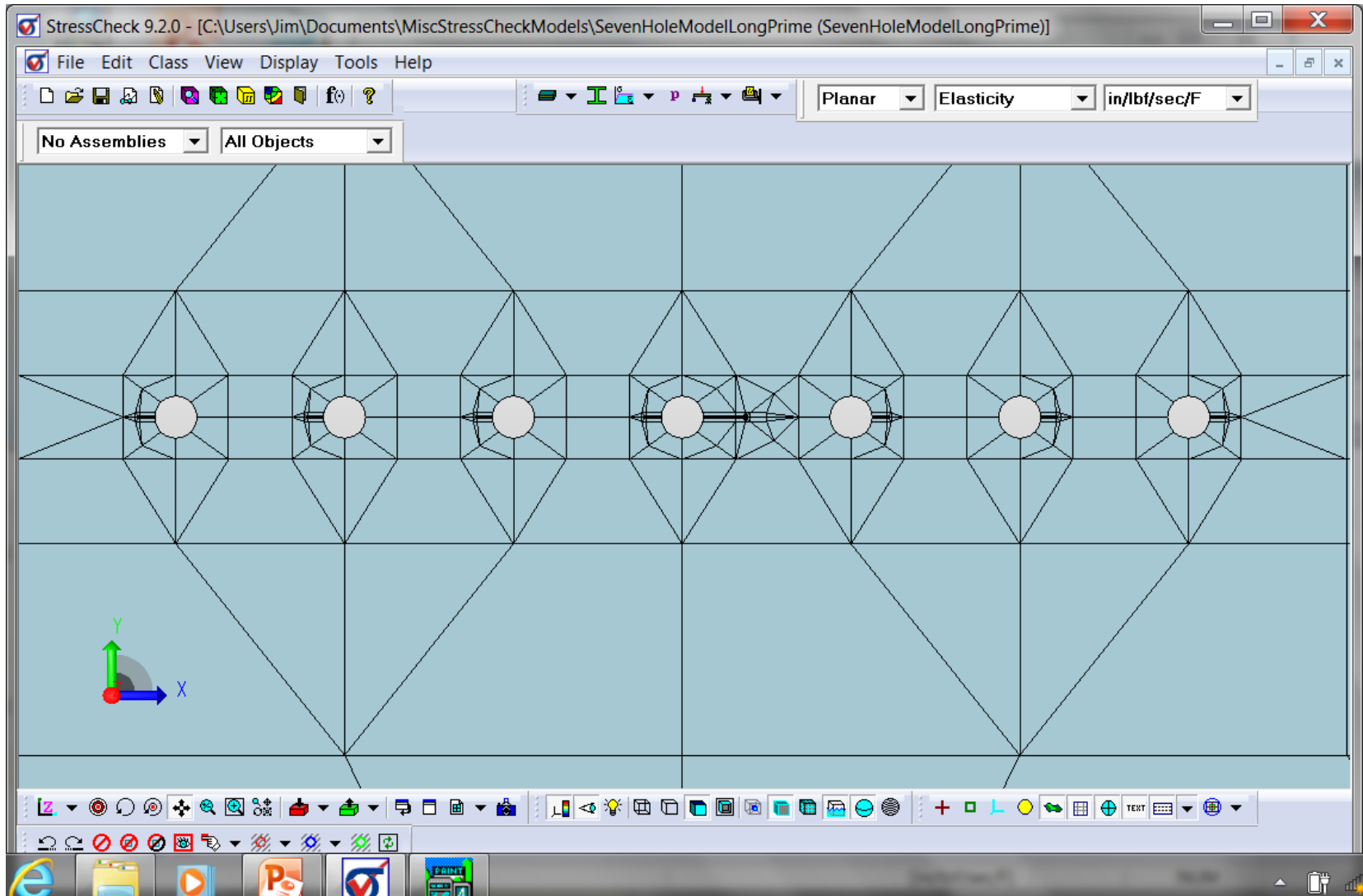
Solution 1



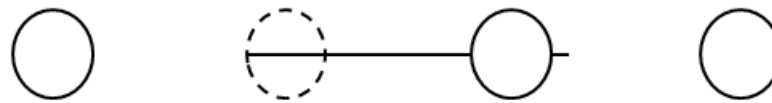
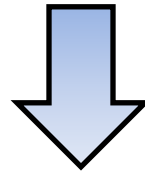
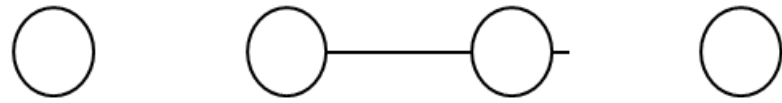
Solution 2

Solution 1

FEM

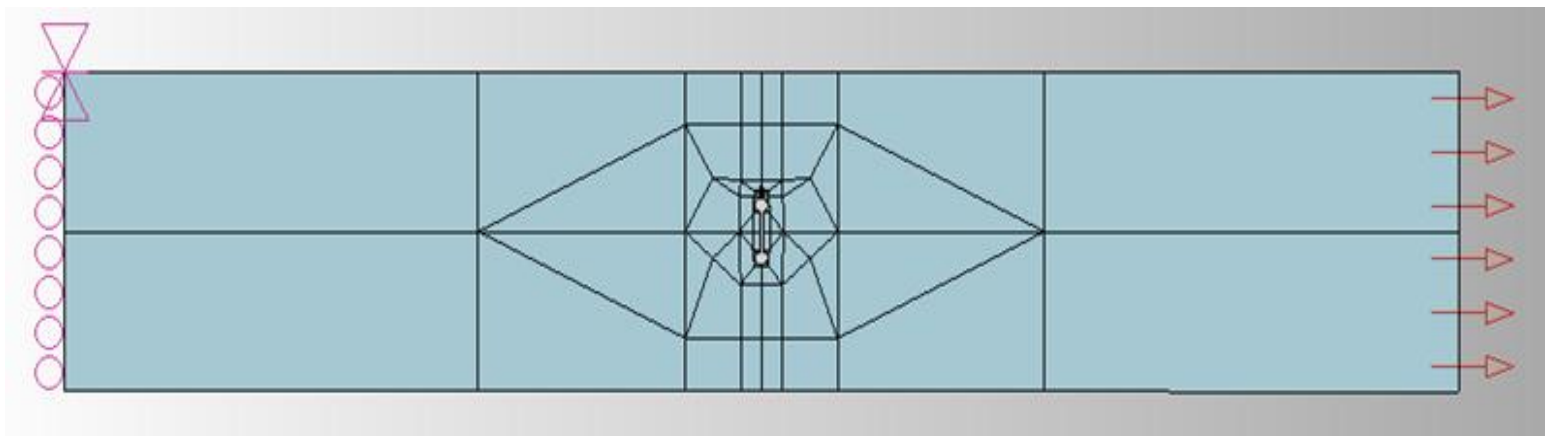
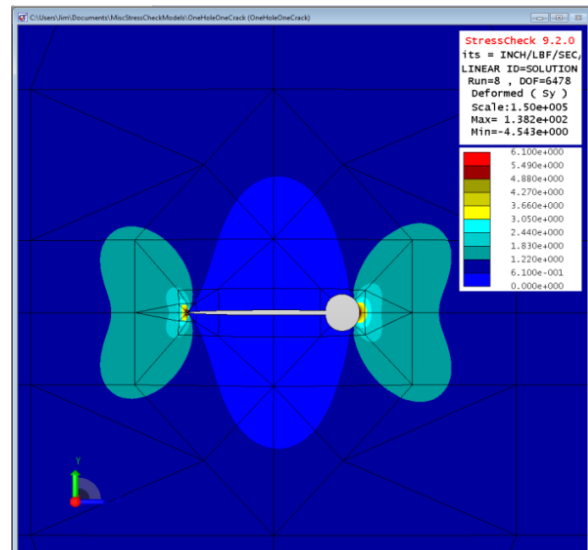
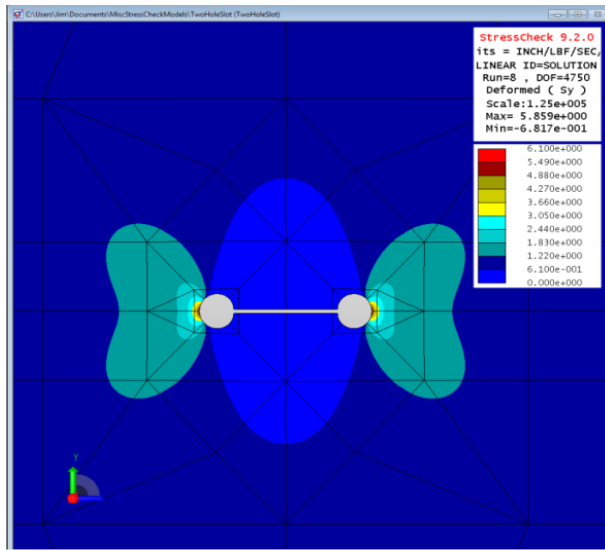


Internal Crack in a Row of Fastener Holes



Modeling Approximation

Verification

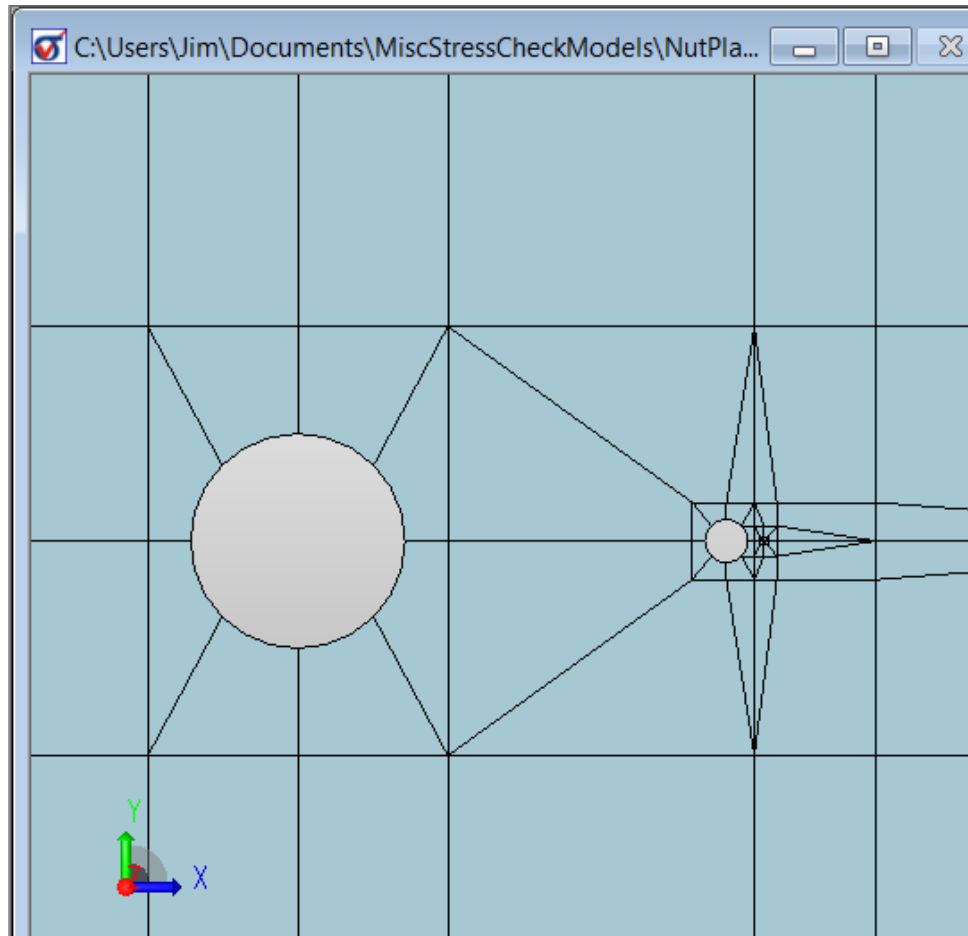


		Hole		Applied		
Width	Dia	Spacing	Thickness	Stress	H/W	
6	0.25	2D	0.25	1	5	
		Two-Hole		One-Hole		
		Slotted Model		2 Crack Model		
C	C/R	KI	Beta	KI	Beta	% Diff
0	0	4.63	5.19486	4.614	5.176908	-0.34557
0.0125	0.1	0.8495	4.286802155	0.8458	4.268131	-0.43555
0.025	0.2	1.033	3.686000424	1.028	3.668159	-0.48403
0.05	0.4	1.16	2.926833726	1.153	2.909172	-0.60345
0.075	0.6	1.203	2.47833528	1.195	2.461854	-0.665
0.1	0.8	1.224	2.183767918	1.215	2.167711	-0.73529
0.15	1.2	1.254	1.826740976	1.243	1.810717	-0.87719
0.25	2	1.309	1.47704833	1.297	1.463508	-0.91673
0.5	4	1.463	1.167305112	1.451	1.15773	-0.82023

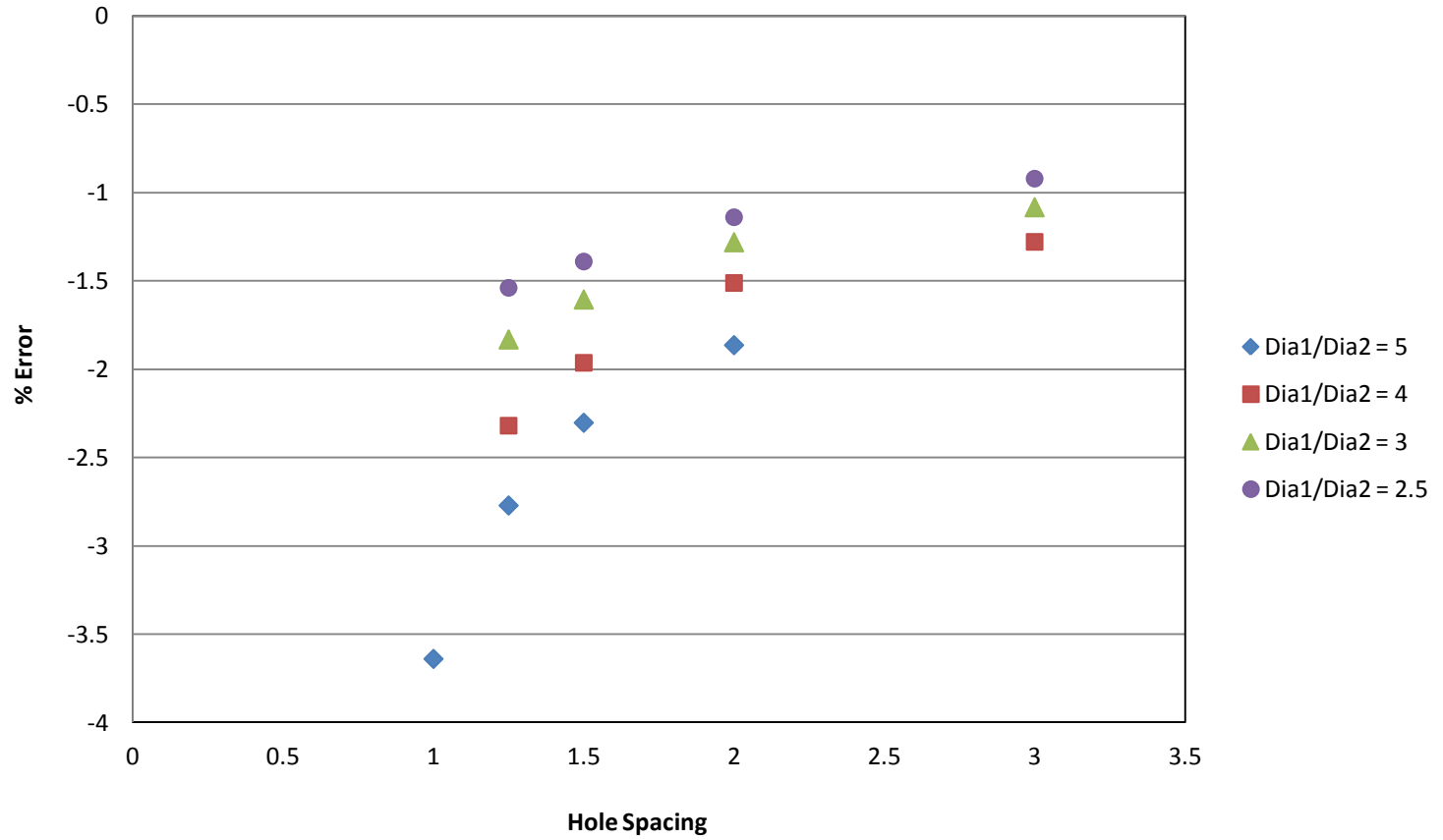
		Hole		Applied		
Width	Dia	Spacing	Thickness	Stress	H/W	
6	0.25	4D	0.25	1	5	
		Two-Hole		One-Hole		
		Slotted Model		2 Crack Model		
C	C/R	KI	Beta	KI	Beta	% Diff
0	0	5.833	6.544626	5.804	6.512088	-0.49717
0.0125	0.1	1.078	5.439873717	1.072	5.409596	-0.55659
0.025	0.2	1.311	4.677973433	1.303	4.649427	-0.61022
0.05	0.4	1.475	3.72162047	1.466	3.698912	-0.61017
0.075	0.6	1.53	3.151997489	1.519	3.129336	-0.71895
0.1	0.8	1.555	2.774313001	1.544	2.754688	-0.7074
0.15	1.2	1.583	2.306005554	1.572	2.289982	-0.69488
0.25	2	1.634	1.843771559	1.623	1.831359	-0.67319
0.5	4	1.782	1.421830287	1.77	1.412256	-0.6734

		Hole		Applied		
Width	Dia	Spacing	Thickness	Stress	H/W	
6	0.25	6D	0.25	1	5	
		Two-Hole		One-Hole		
		Slotted Model		2 Crack Model		
C	C/R	KI	Beta	KI	Beta	% Diff
0	0	6.942	7.788924	6.905	7.74741	-0.53299
0.0125	0.1	1.284	6.479404317	1.277	6.44408	-0.54517
0.025	0.2	1.564	5.580740235	1.556	5.552194	-0.51151
0.05	0.4	1.763	4.448282636	1.753	4.423051	-0.56721
0.075	0.6	1.83	3.770036212	1.819	3.747375	-0.60109
0.1	0.8	1.859	3.316686732	1.847	3.295277	-0.64551
0.15	1.2	1.892	2.756135508	1.88	2.738655	-0.63425
0.25	2	1.947	2.196954238	1.935	2.183414	-0.61633
0.5	4	2.109	1.682738539	2.096	1.672366	-0.61641

Internal Crack Between Un-Equal Holes



Solution Error



Discussion