METHODOLOGY FOR OPTIMIZATION OF SHELL STRUCTURES

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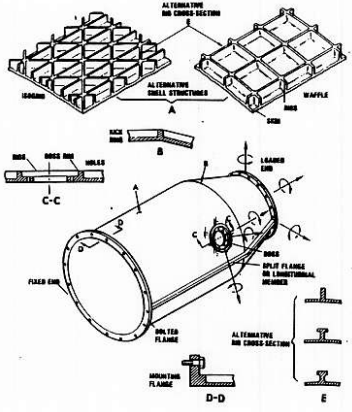
OBJECTIVES

- CAE & CAD of cylinder, cone isogrid & waffle shell structures
- Structure optimization
- Provide process visibility for user
- Provide facilities for user verification of analyses
- Generate complete design definition & drawings

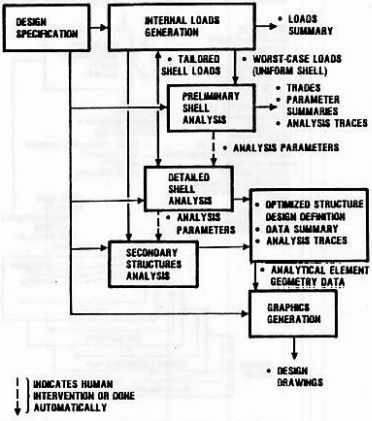
EXPERT SYSTEM FEATURES

- Processes are primarily controlled by input specification
- Human intervention is minimized
- Internal structural loads are based on tailored or untailored structures
- Trades are automatically generated for human intervention guidance
- Analysis traces are provided for user visibility & verification
- Analytical element design definition parameters are automatically transformed into physical model

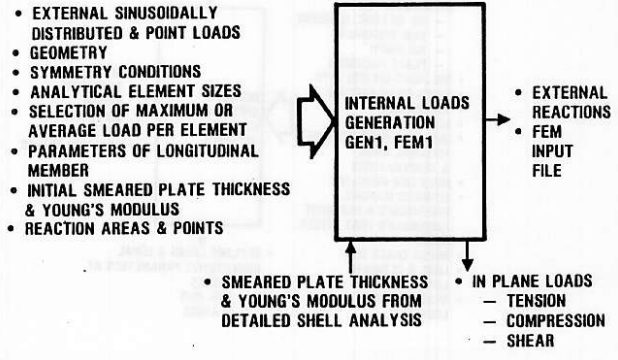
TYPICAL SHELL CONFIGURATION



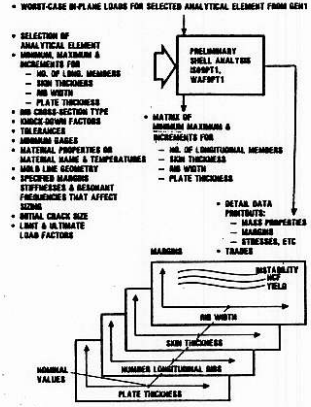
OVERALL SYSTEM



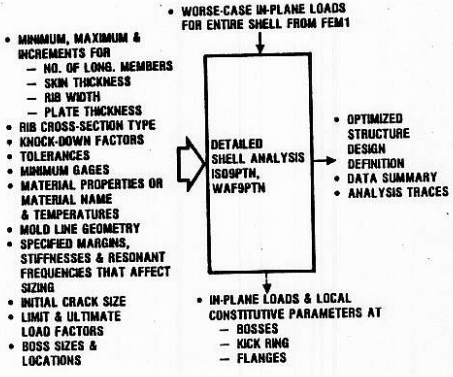
INTERNAL LOADS GENERATION I/O



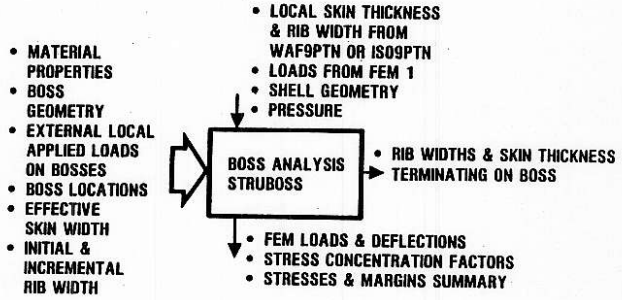
PRELIMINARY SHELL ANALYSIS



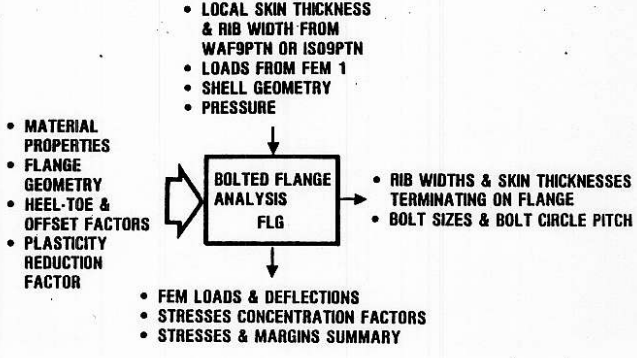
DETAILED SHELL ANALYSIS



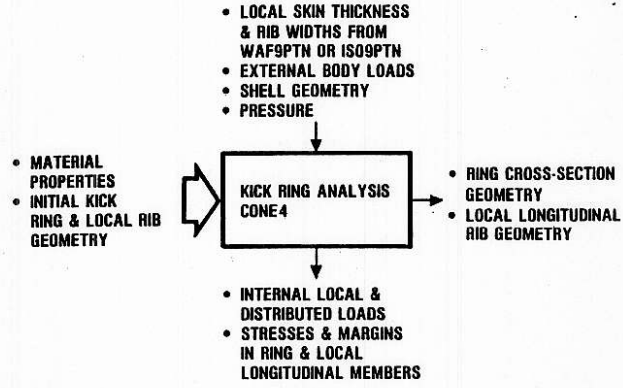
BOSS ANALYSIS



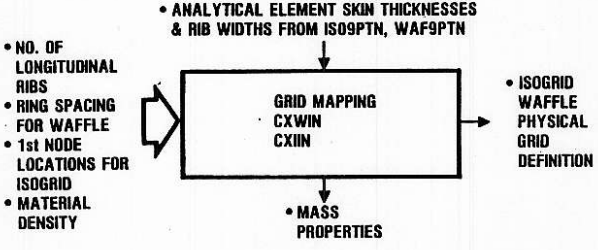
BOLTED FLANGE ANALYSIS



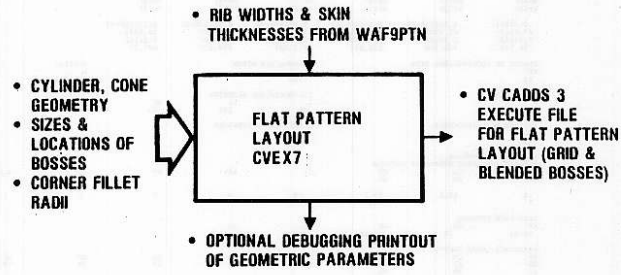
KICK RING ANALYSIS



ANALYTICAL-TO-PHYSICAL MODEL GRID MAPPING



FLAT PATTERN LAYOUT



INTERNAL LOADS, GENI

GENATLAS/G AVERAGE, CONVENTIONAL, COMBINED TYPE 1 LOADS SHEARING - UIATLAS/G 1/12/84

TA	C(TA)	HX	HY	VX	VY
1	0	0	1.8E+06	10000	0
2	57	0	2.7E+06	31750	0
3	107	0	3.38+06	36666	0
4	157	0	4.05E+06	42187.5	0
5	205	0	4.5E+06	43720.5	0

L(1) RC(1)	L(2) RC(2)	L(3) RC(3)	L(4) RC(4)	L(5) RC(5)	L7 F	TN	FA
57 59.575	50 66	50 66	46 66	16 63	221 0	0	-70991.7

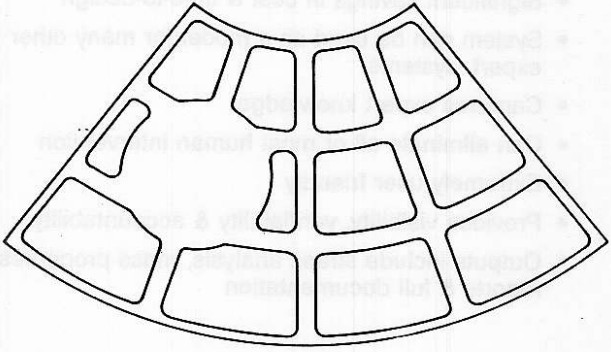
SECTION 1

TA	NC	NE	V	VE
10	212	1	188	159
20	234	1	183	155
30	255	1	172	147
40	275	1	157	133
50	292	1	137	116
60	306	1	112	95
70	316	1	84	71
80	324	1	54	45
90	327	1	21	18

SECTION 2

TA	NC	NE	V	VE
10	194	1	190	162
20	222	1	186	158
30	248	1	175	149
40	272	1	159	135
50	294	1	139	118
60	311	1	114	97
70	325	1	85	72
80	333	1	54	46
90	338	1	22	18

WAFFLE FLAT PATTERN LAYOUT



DESIGN SPECIFICATION SUMMARY

- WAFFLE OR ISOGRID CONSTRUCTION
- MATERIAL PROPERTIES
- EXTERNAL SHELL & BOSS LOADS
- SHELL GEOMETRY
- BOSS SIZES, LOCATIONS & HOLES
- ANALYTICAL ELEMENT PARAMETERS
- ANALYTICAL ELEMENT INTERNAL LOAD CRITERIA
- ULTIMATE LIMIT & KNOCK DOWN FACTORS
- REFERENCE RIB CROSS-SECTION
- MINIMUM GAGES & TOLERANCES
- INITIAL MINIMUM, MAXIMUM & INCREMENTAL VALUES FOR SKIN & PLATE THICKNESS, RIB WIDTH & NUMBER OF LONGITUDINAL RIBS (BOUNDS OF OPTIMIZATION)
- INITIAL KICK RING CONFIGURATION
- INITIAL CRACK SIZE FOR CRACK GROWTH ANALYSIS
- POWER SPECTRAL DENSITY OF ENVIRONMENT FOR HCF ANALYSIS
- SELECTIONS OF MARGINS, RESONANT FREQUENCIES, ETC TO BE USED IN STRUCTURAL SIZING
- BASELINES FOR TRADES & TRACES
- RING SPACING FOR WAFFLE OR POSITIONS OF FIRST MODES IN ISOGRID
- BOLTED FLANGE CONFIGURATION
- WEIGHT ESTIMATING CRITERIA
- ENGLISH OR SI UNITS