

KOREA 2021

DISCOVERY SUMMIT

EXPLORING DATA
INSPIRING INNOVATION



SQLite DB와 TOPSIS 신경망모델을 적용한 수상함 초기설계 최적화 프로세스

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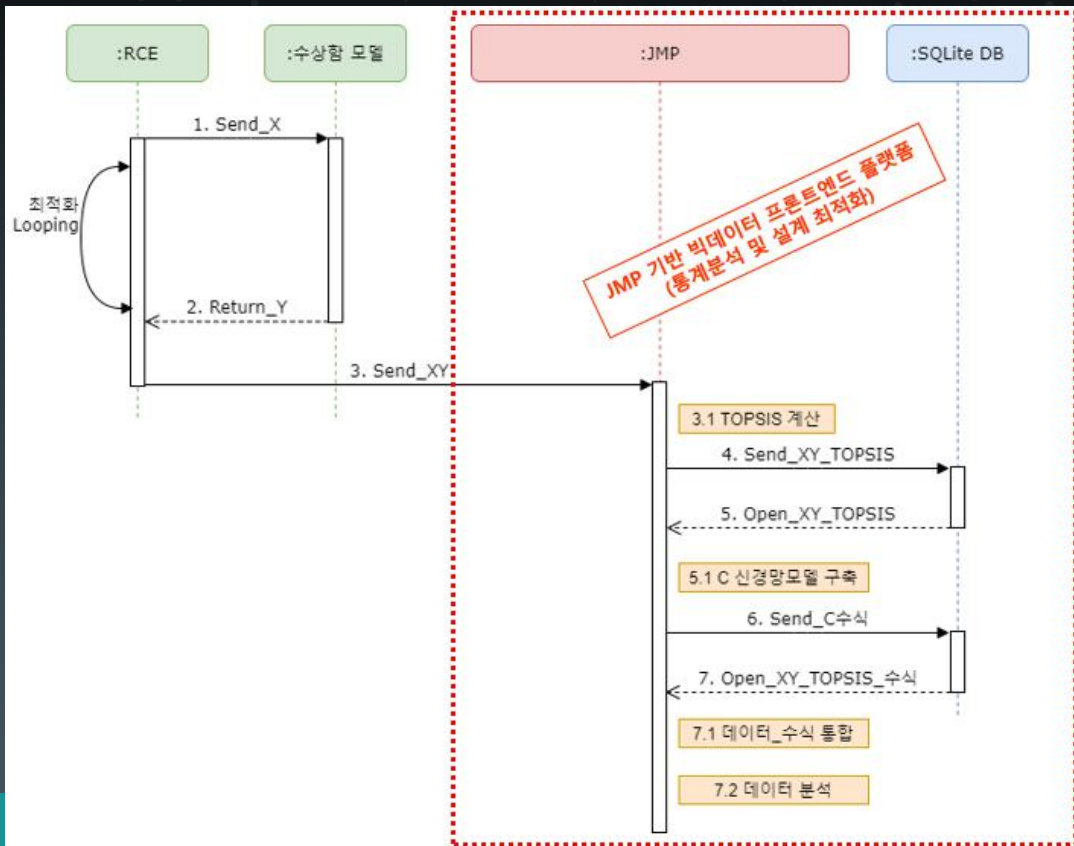
박진원수석

대우조선해양 중앙연구원

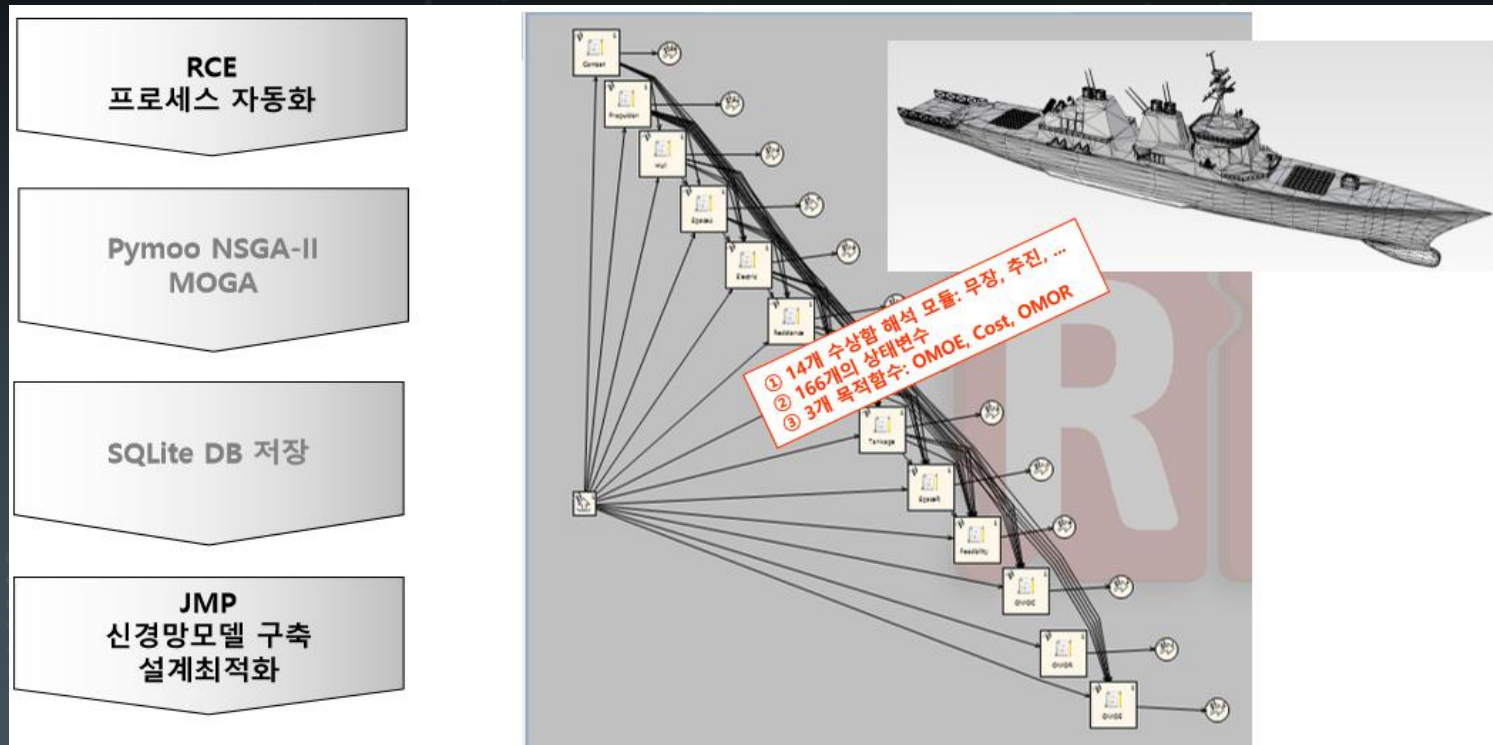
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과제 개요(Sequence Diagram)



1. RCE 통합설계 프레임워크: 수상함모델 통합 및 설계 최적화



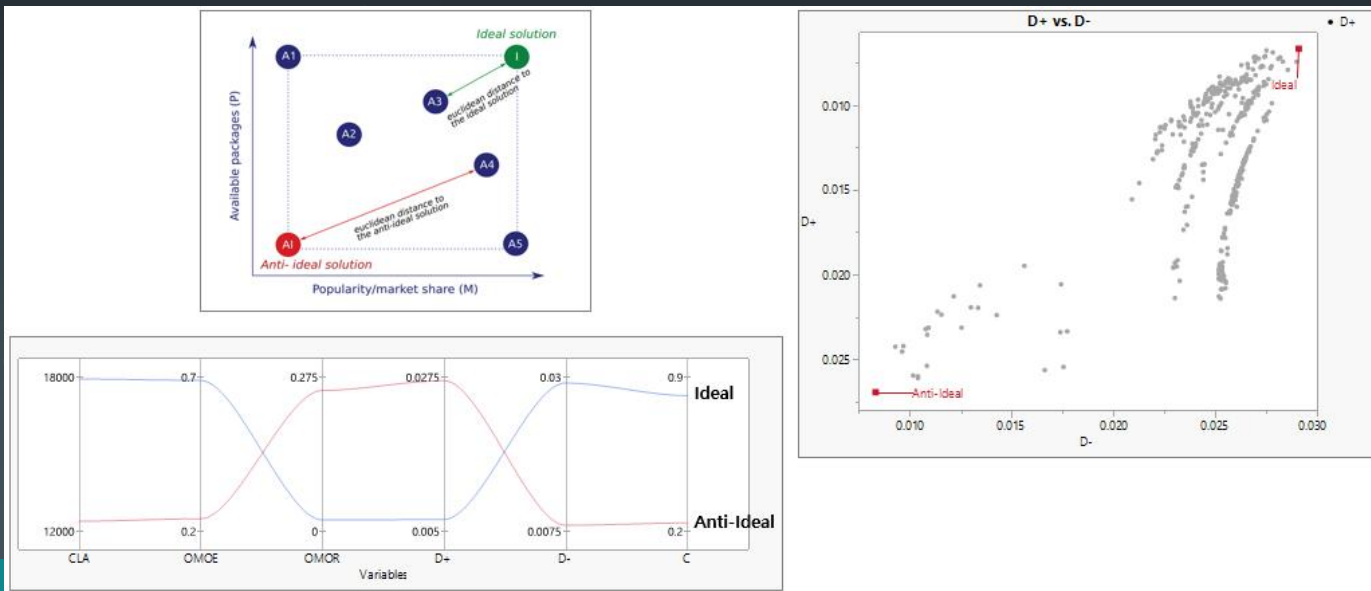
2. 수상함 초기설계 DB

2.1 TOPSIS(Technique for Order of Preference by Similarity to Ideal Solution) 신경망모델 구축

> MCDA(Multi-Criteria Decision Analysis)

- 3개 목적함수를 하나의 성능지표로 표현

> D+(이상해 Ideal)에 가깝고, D-(반이상해 Anti-Ideal)에서 먼 성능지표: Min D+, Max D-



2. 수상함 초기설계 DB

2.2 SQLite DB

> data table("NSGA2_v10_377") << **Save Database**(dsn, "NSGA2_v10_377");

The screenshot displays the DBBeaver 21.2.0 interface. The main window shows a SQLite database named 'NSGA2_v10_377'. The table 'NSGA2_v10_377' is selected, and its data is displayed in a grid. The columns are 'Iter', 'AAW', 'ASUW', 'ASW', 'GMLS', 'LAMPS', and 'CCC'. The data rows range from 351 to 377. The interface also shows a sidebar with a tree view of the database structure, including tables like 'NSGA2_Eqn' and 'NSGA2_v10_377', and a right-hand pane for table properties and column lists.

Record	Iter	AAW	ASUW	ASW	GMLS	LAMPS	CCC
351	351	8	4	2	7		
352	352	8	3	7	7		
353	353	9	4	8	7		
354	354	7	2	8	2		
355	355	8	4	8	7		
356	356	9	4	9	7		
357	357	8	2	6	2		
358	358	9	4	3	7		
359	359	8	4	8	7		
360	360	8	4	9	7		
361	361	7	4	8	7		
362	362	8	4	9	7		
363	363	8	4	8	7		
364	364	3	4	3	2		
365	365	6	4	9	7		
366	366	8	4	8	7		
367	367	8	4	8	7		
368	368	9	2	3	4		
369	369	3	1	1	6		
370	370	6	2	3	4		
371	371	3	3	4	4		
372	372	8	1	8	4		
373	373	8	2	3	6		
374	374	8	2	4	6		
375	375	4	2	3	2		
376	376	4	4	4	2		
377	377	2	2	3	3		

4. 수상함 초기설계 DB 분석

4.1 DB 데이터와 수식 결합 자동화

> eqn = data table("NSGA2_Eqn"):Eqn[1];

> data table("NSGA2_v10_377") << **New Column("C_Eqn", formula(eqn));**

The screenshot displays the JMP Pro interface for a data table named 'NSGA2_v10_377'. The table has columns: D+, D-, C, C_Rank, Remark, and C_Eqn. The 'C_Eqn' column contains numerical values. A 'New Column' dialog box is open, showing a list of functions and a preview of a TanH function.

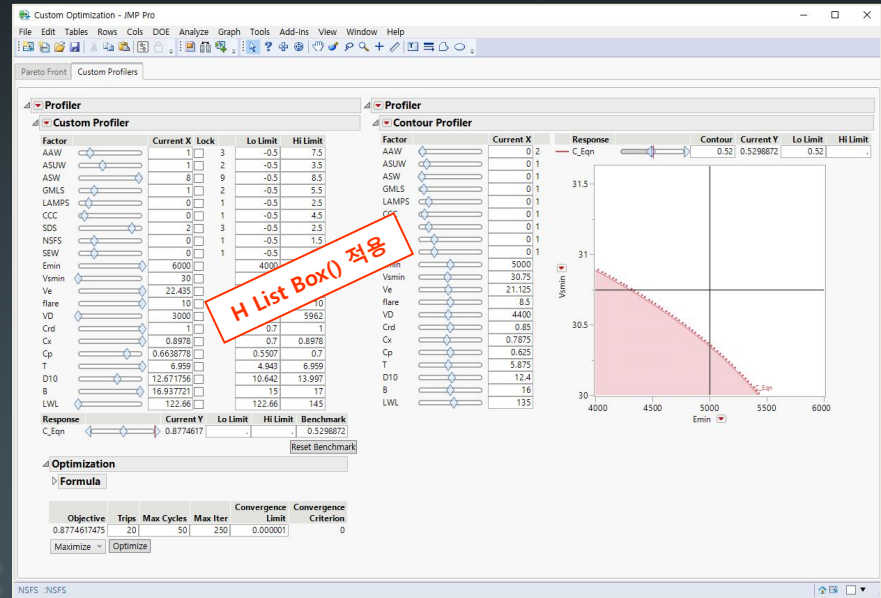
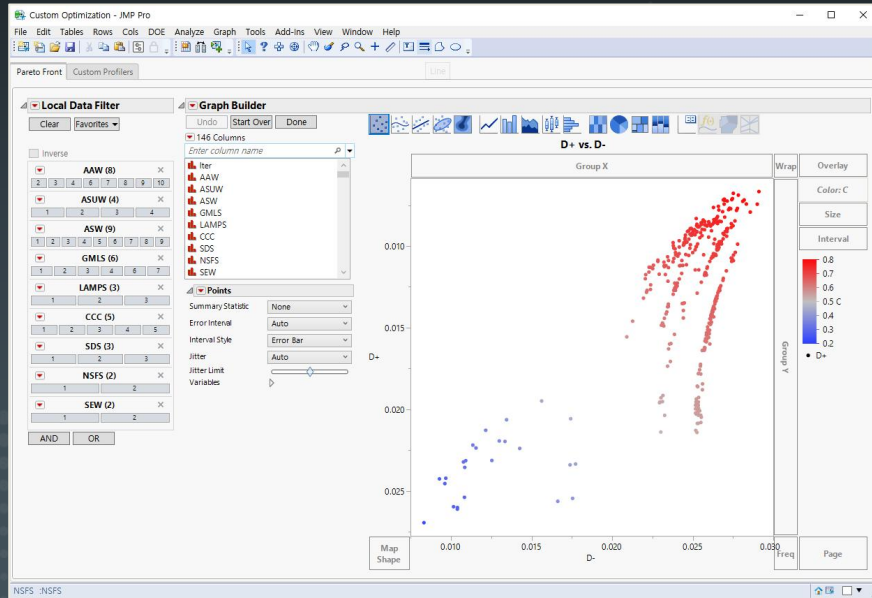
Iter	AAW	ASUW	ASW	GMLS	LAMPS	CCC	SDS	NSFS	SEW	Emin	Vsmin	C	C_Rank	Remark	C_Eqn
358	59897	0.013701269	0.023485871	0.631558952	267	0.61238636									
359	62502	0.016246044	0.025722582	0.612900263	290	0.60088253									
360	77322	0.016382566	0.025715365	0.610846293	293	0.61113016									
361	69384	0.020307261	0.025346238	0.555187199	335										
362	52094	0.017349545	0.02547487	0.594867903	303										
363	03477	0.020355844	0.025346508	0.554599631	338										
364	05641	0.009672083	0.024155938	0.714080732	135										
365	52206	0.017239989	0.025481566	0.596456901	301										
366	67521	0.019793541	0.025291929	0.560977385	325										
367	98804	0.02015284	0.025298546	0.556606701	333										
368	26848	0.010537898	0.023938917	0.69434827	160										
369	06364	0.011297091	0.02228782	0.663626006	212										
370	86032	0.009917585	0.024853763	0.714777101	131										
371	75347	0.008769304	0.026108301	0.748569201	55										
372	83143	0.011183206	0.024379924	0.685539319	178										
373	82027	0.01004304	0.025205913	0.715082599	129										
374	94267	0.010549372	0.027526462	0.722937871	111										
375	4853	0.009571995	0.024758428	0.721180402	116										
0	376	24899	0.007712481	0.027353609	0.780058704	19									
0	377	28196	0.009494433	0.024527199	0.720929523	117									

4. 수상함 초기설계 DB 분석

4.2 DB 데이터 기반 분석 결과 대시보드

> nw = New Window("Custom Optimization", tb = Tab Box());

tb << Append(...

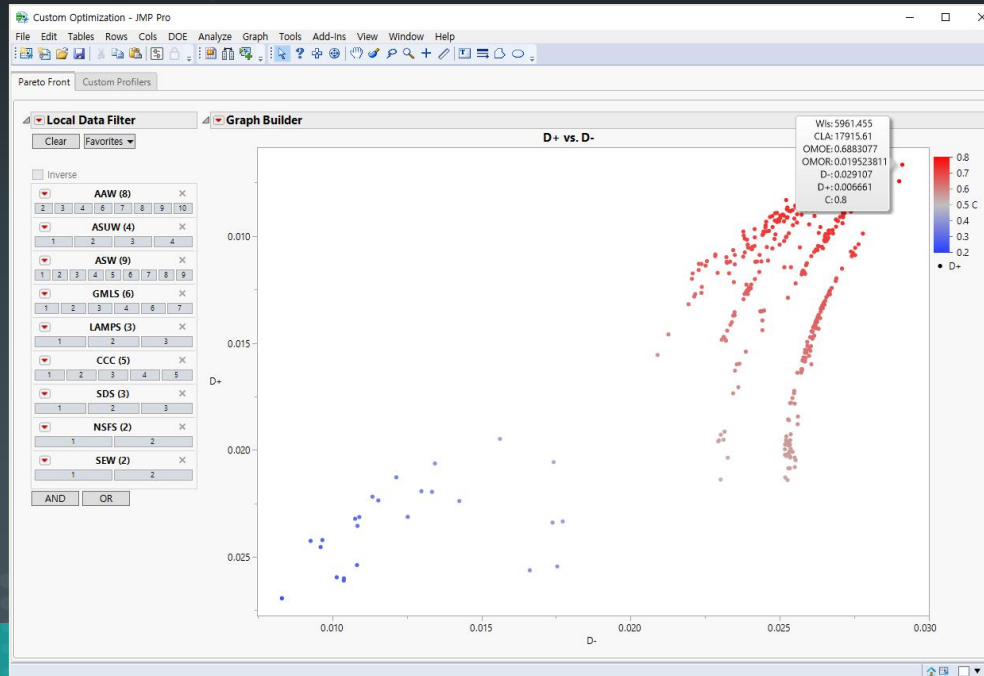


4. 수상함 초기설계 DB 분석

4.3 Pareto Front

> Local Data Filter

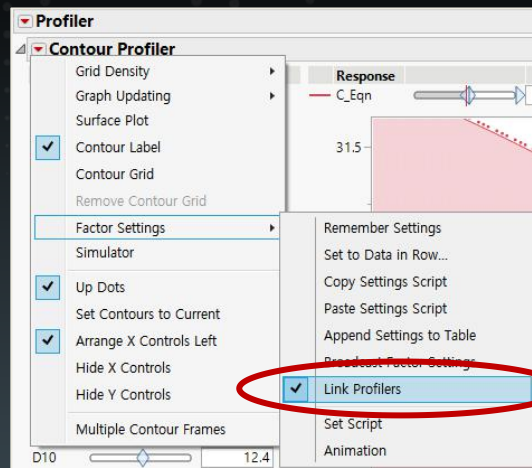
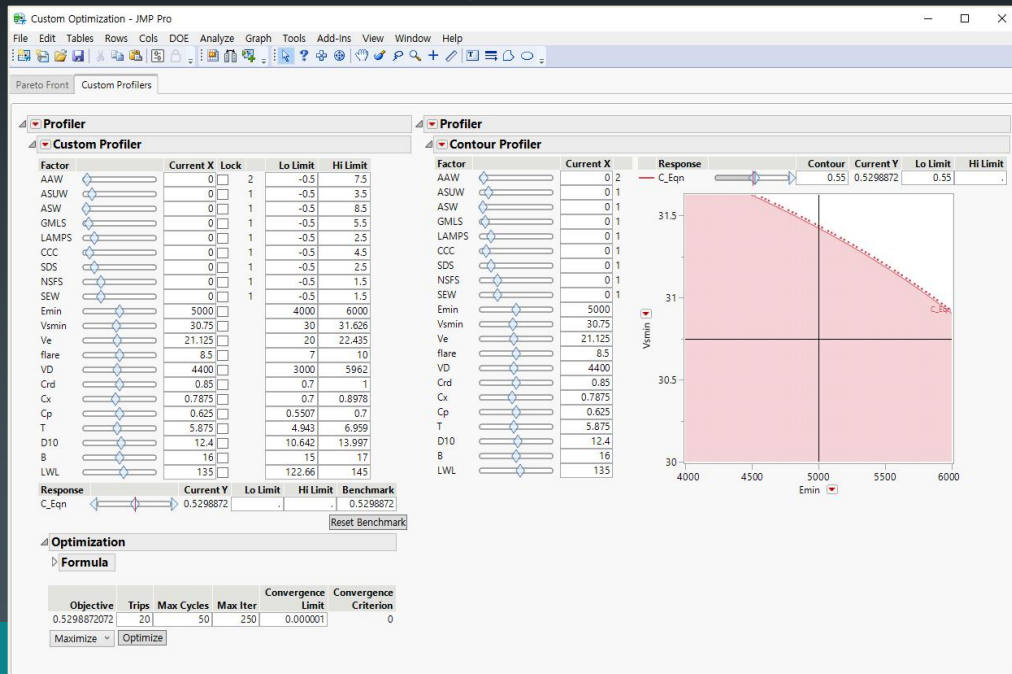
- 대공전(AAW), 대함전(ASW), 대잠전(ASUW), 지상지원 등



4. 수상함 초기설계 DB 분석

4.4 Custom Profilers

- > MCDA => Single Performance Index => Desirability Function 적용 가능
- > Custom profiler와 Contour Profiler를 **Link Profilers** (매개변수 연동화)

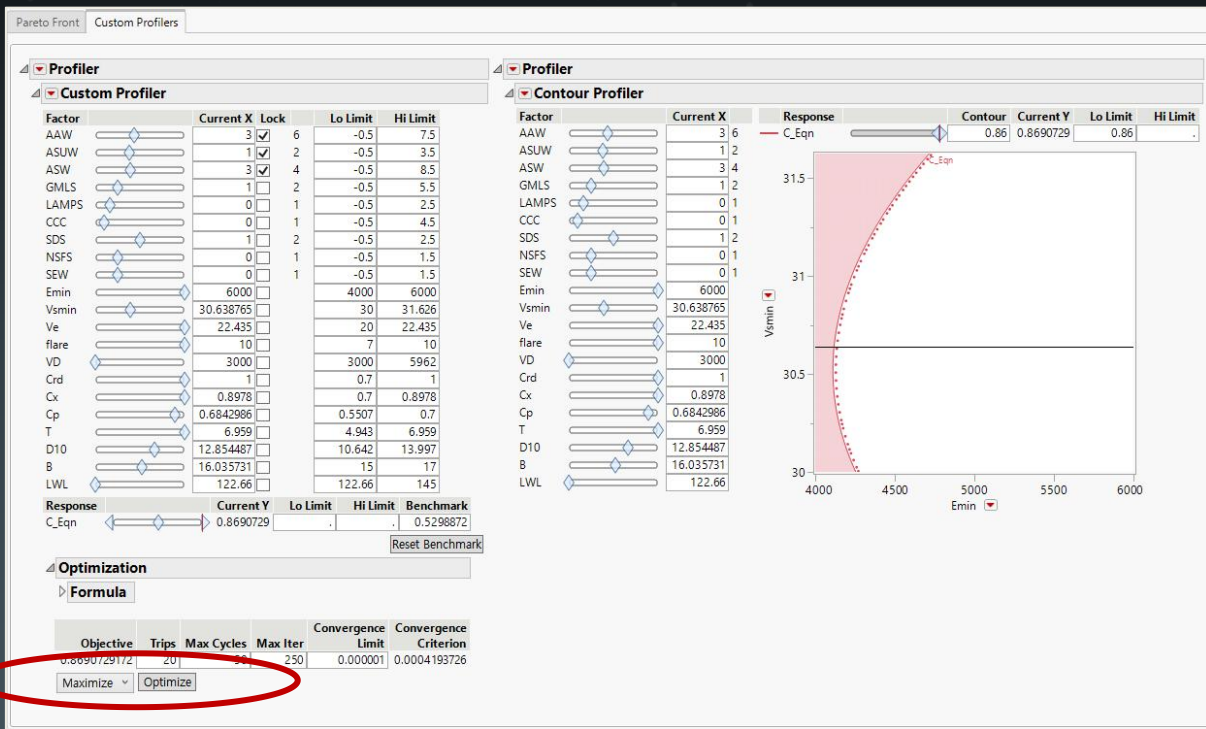


4. 수상함 초기설계 DB 분석

4.4 Custom Profilers

> 설계 최적화 진행

- 고정: AAW=3, ASUW = 2, ASW = 3
- 만족도함수: 0.53 => 0.89로 향상



결론

1. 시뮬레이션 데이터의 DB화

- SQLite, MariaDB

2. JMP Front-End Design Platform 구축

- 통계분석 및 최적화 가능

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