Learning to Computationally Design Engineered Systems

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http://ideal.umd.edu/papers/paper/jmd-design-manifolds
http://dx.doi.org/10.1115/1.4036134
https://github.com/IDEALLab/design_embeddings_jmd_2016
http://ideal.umd.edu/papers/paper/idetc-hgan
https://github.com/IDEALLab/hgan_idetc2018
Active Expansion Sampling (AES)

Wei Chen and Mark Fuge, “Active Expansion Sampling for Learning Feasible Domains in an Unbounded Input Space”. Structural and Multidisciplinary Optimization 57 (3) 2018.

http://ideal.umd.edu/papers/paper/samo-aes
https://github.com/IDEALLab/Active-Expansion-Sampling
http://ideal.umd.edu/papers/paper/jmd-feasible-designs
https://github.com/IDEALLab/domain_expansion_jmd_2017
Electro-Static Potential

100V

0V
Electro-Magnetics
Adjoint ( $\partial \text{Drag}/\partial \bar{u}$ ) for Grounded Box
Growing a sail to take advantage of wind
Specification

V=16 m/s
Trigger force < 2 N
Trigger displacement < 1cm
Prime force < 10 N
Prime displacement < 7 cm
Fire n darts

Functional Model

Human energy

Abstract dart storage
Dart enerzation
Dart with TME

Human energy

Abstract energy storage
AE
Triggered abstract energy modulator
AE
Transform AE to translational ME

Behavior Description

Different behavior models

Structural Realization

Spring

Handle

Elastic Volume

0 DoF Constraint

Air Volume

Trigger

Fixed Rigid Body

Free Rigid Body

Dart
Compositional Commitments
Challenges/Opportunities

1. Multiphysics Optimization of Multiple Assembled Parts
Challenges/Opportunities

2. Computing Multiphysics Composition in Energy Systems

ARPA-E Wave Disk Engine
Challenges/Opportunities

2. Computing Multiphysics Composition in Energy Systems

W7-X Stellarator