A clustering algorithm for reduced order modeling of shock waves

Flow Domain Structures

K-Means Flow Domain Clustering

*NEW METHOD*

- K-means clusters the rows of each computed column cluster
- Creates a board of sub-matrices for reduced order model

Results – 2D Flow

- 2D URANS solution of oscillating airfoil
- Improvement for flows without shocks

Results – Shock wave

- Simple 1D Berger’s equation solution
- Demonstration case for shock modeling

Background

Shock Wave Modeling

2D Flow Test Case: Oscillating Blade

Oscillating Blade 2D Flow Test Case:

• Shock wave over jet

Supersonic flow around gas turbine engine fan

Means Column Clustering

Shock Wave Modeling

K-Means Column Clustering

- Snapshots of the simulation data stored in a vector
- Multiple snapshots stored in columns of matrix
- K-means clusters the columns into similar snapshots