

JSDL Parameter Sweep Extension with support for input file sweeping

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Motivation

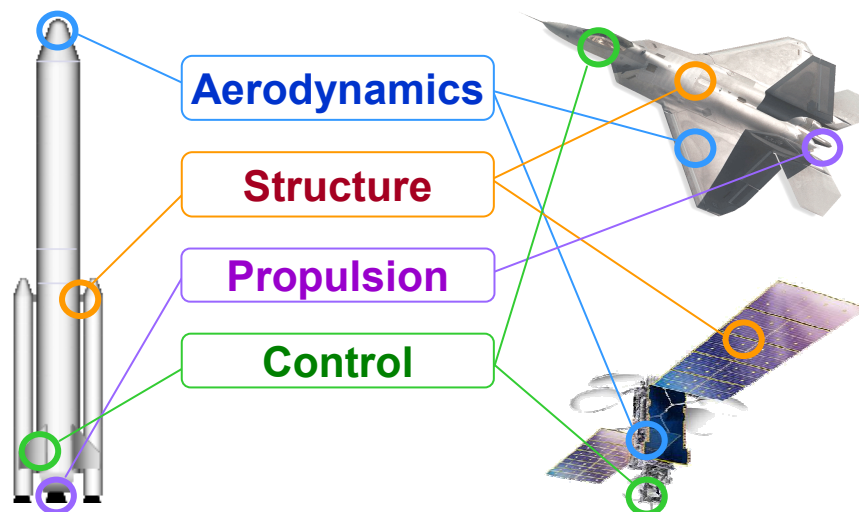


- Existing JSDL-PS facilitates sweeping over elements defined **within the JSDL document** itself
- Additional requirement to sweep over parameters that exist **within input files**
- Proposal
 - Identify named input files using <TemplatedFile/>
 - Define 'placeholder' variables within the named input files, e.g., '\${RE}'
 - Use existing JSDL-PS functions and nesting semantics to assign values to placeholder variables.

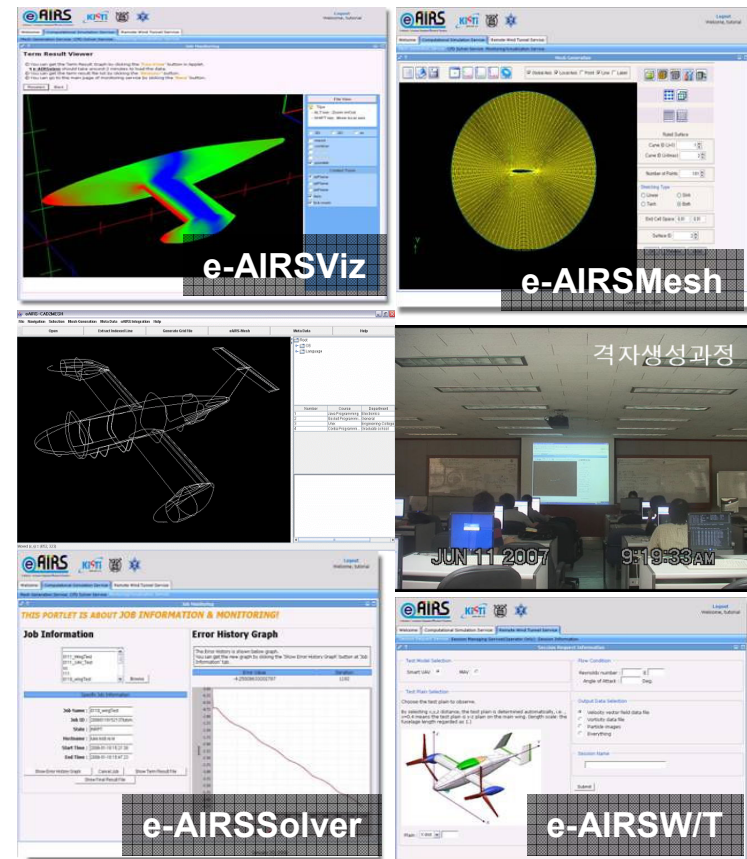
e-AIRS(e-Science Aerospace Integrated Research System)



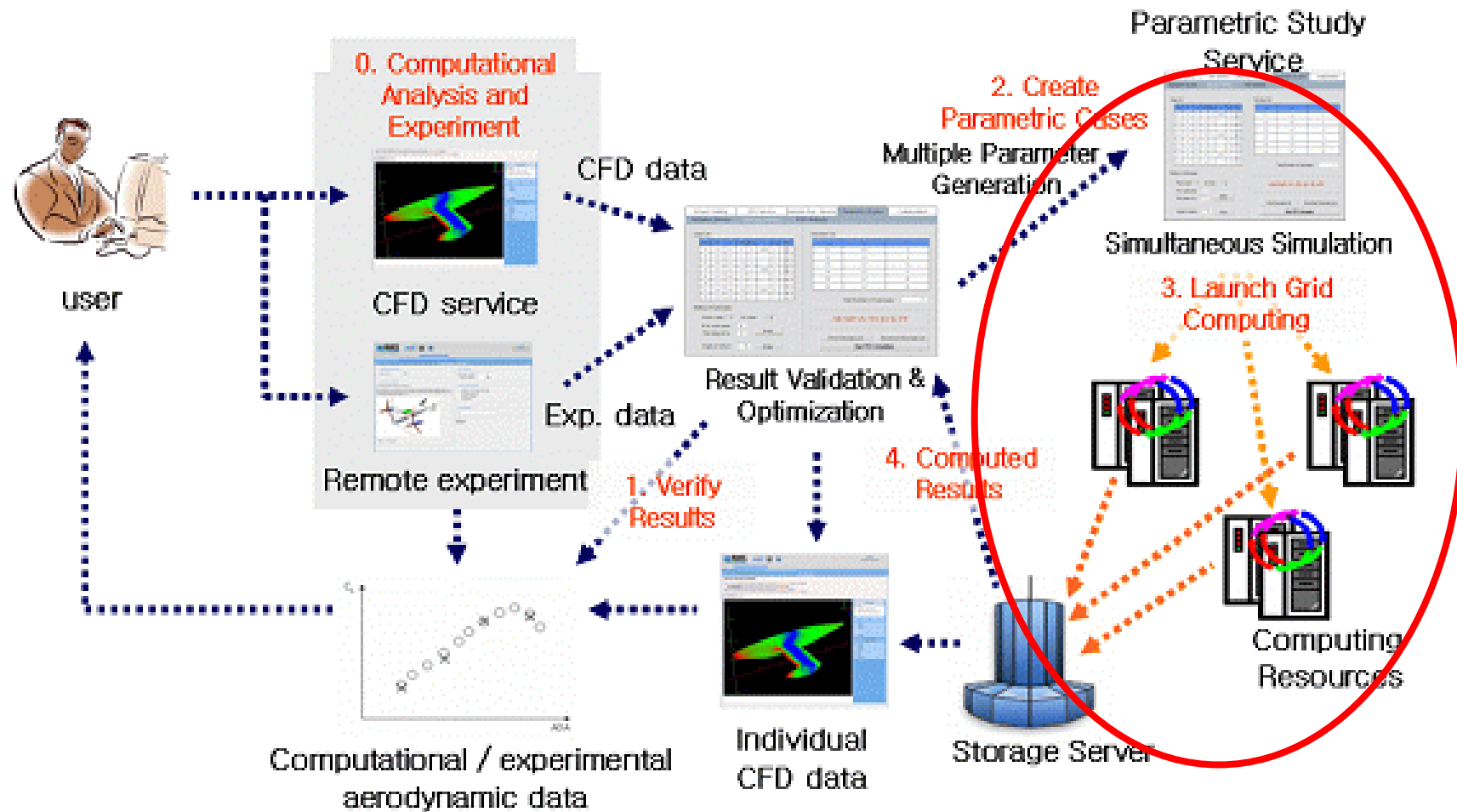
- Next-generation R&D Paradigm : Combination of ICT and Space Tech.
- Construction of Space Tech. CI/CE for Large-scale Research Activities
- Co-use of Research Facilities and Data, Cyber Education



- Multi-disciplinary Research
- Integration of Computation and Experiment
- Large-scale Computation and Huge Data
- Korea Aerospace-Net Community



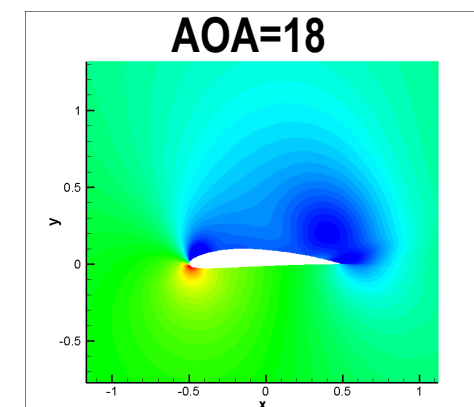
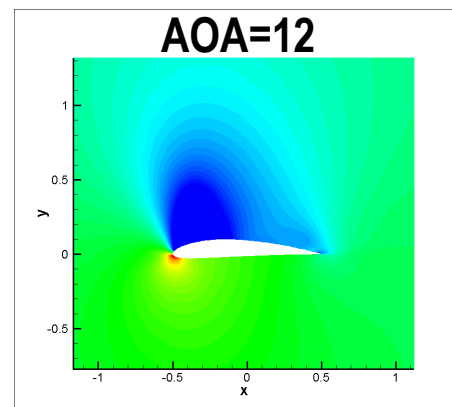
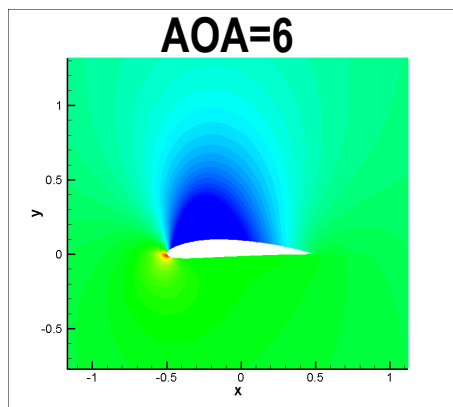
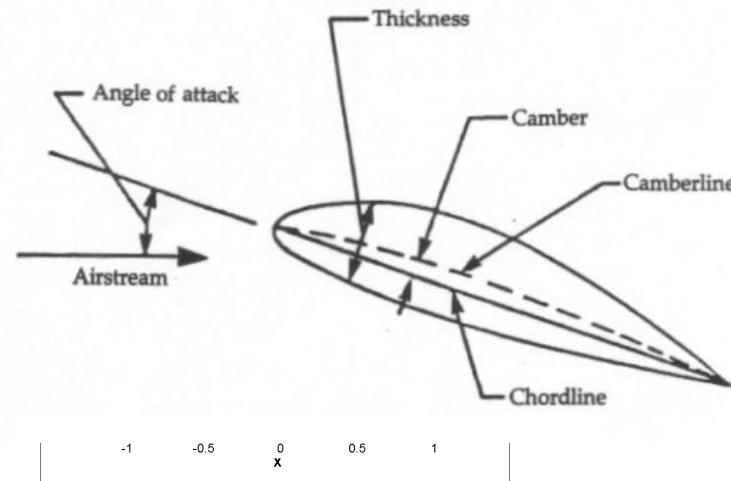
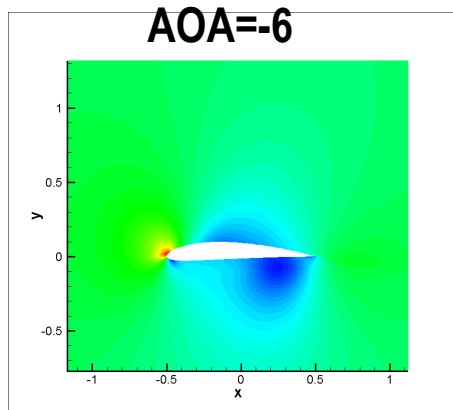
Overview of eAIRS



Usage Case

- Solver : 2D_Comp(two-dimensional, compressible flowfield around a airfoil)
- Argument type : -mesh mesh_name, -param param_input
- Geometry (mesh) : NACA4412
- AOA : -6, -4, -2, 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20
- Total 14 jobs at a time

```
AMACH 0.6d0
RE 5.0d6
AOA -6.0d0
TOL 1.0d-4
TINF 290.0d0
CFL 0.5d0
IERRWRT 1
TOTPES 6
NSEULER -1
KWKEBL 0
INTWRT2 50
ITMAX2 10000
STEADINESS 0
```



JSDL-PS extension with support for input parameter file



- JSDL parameter sweep extension

```
<Sweep>  
  <Assignment/>  
  <Sweep/>  
</Sweep>
```

- Input parameter file sweep extension

```
<Sweep>  
  <Assignment/>  
  <TemplatedFile/>  
  <Sweep/>  
</Sweep>
```

TemplatedFile Element Structure

```
<TemplatedFile>  
  <Parameter/>  
  <File>  
    <Location>  
    <Name>  
  </File/>  
  <FileSweep>  
    <FileAssignment>  
      <Placeholder/>  
      <Function/>  
    <FileAssignment>  
  </FileSweep>  
</TemplatedFile>
```

Extension of Sweep Element -Serial Example



```
<sweep:Sweep>
  <sweep:TemplatedFile>
    <sweep:Parameter>/*/jsdl-posix:POSIXApplication/jsdl-posix:Argument[4]</sweep:Parameter>
    <sweep:File Prefix="endowed" Extension="inp">
      <sweep:Location>"gsiftp://eairs.kisti.re.kr/tutorial/snu/"</sweep:Location>
      <sweep:Name>"endowed.inp"</sweep:Name>
    </sweep:File>
    <sweep:FileSweep>
      <sweep:FileAssignment>
        <sweep:Placeholder name="{Mach}" default="0.7"/>
        <sweepfunc:Values>
          <sweepfunc:Value>0.7</sweepfunc:Value>
          <sweepfunc:Value>3.7</sweepfunc:Value>
        </sweepfunc:Values>
      </sweep:FileAssignment>
    </sweep:FileSweep>
    <sweep:FileSweep>
      <sweep:FileAssignment>
        <sweep:Placeholder name="{RE}" default="5.0"/>
        <sweepfunc:Values>
          <sweepfunc:Value>5.0</sweepfunc:Value>
          <sweepfunc:Value>10.0</sweepfunc:Value>
        </sweepfunc:Values>
      </sweep:FileAssignment>
    </sweep:FileSweep>
  </sweep:TemplatedFile>
</sweep:Sweep>
```

Back up

Placeholder

- Placeholder
 - Indicates a **specific parameter location and default value** within an templated file
 - Has a name and value based on xsd:string

```
<xsd:complexType name="Placeholder_Type" mixed="false">  
  <xsd:attribute name="default" type="xsd:string" use="required"/>  
  <xsd:attribute name="name" type="xsd:string" use="required"/>  
</xsd:complexType>
```

- Function
 - Yield a finite set of values
 - It is same as the function in [Assignment]

FileAssignment

- Defines which [Placeholder]s within an templated file are affected by which [Function]
 - Similar to <sweep:Assignment>

```
<xsd:complexType name="FileAssignment_Type" mixed="false">  
  <xsd:sequence>  
    <xsd:element ref="sweep:Placeholder" maxOccurs="unbounded"/>  
    <xsd:element ref="sweep:Function"/>  
  </xsd:sequence>  
</xsd:complexType>
```

AMACH **\${Mach}** d0

RE **\${RE}** d6

AOA 6.0d0

TOL 1.0d-4

.

.

<sweep:FileAssignment>

<sweep:Placeholder name="**\${Mcha}**" default="0.7"/>

<sweepfunc:Values>

<sweepfunc:Value>0.7</sweepfunc:Value>

<sweepfunc:Value>3.7</sweepfunc:Value>

</sweepfunc:Values>

</sweep:FileAssignment>

FileSweep (1/2)

- Its function is similar to <sweep:Sweep>
- It contains multiple FileAssignment elements
 - For supports sweeping the values of the parameters defined within an templated file
- It contains recursively for nested sweep

```
<xsd:complexType name="FileSweep_Type" mixed="false">
  <xsd:sequence>
    <xsd:element ref="sweep:FileAssignment" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="sweep:FileSweep" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
</xsd:complexType>
```

FileSweep (2/2)

```
AMACH ${Mach} d0  
RE ${RE} d6  
AOA 6.0d0  
TOL 1.0d-4  
.  
.
```

```
<sweep:FileSweep>  
  <sweep:FileAssignment>  
    <sweep:Placeholder name="${Mach}" default="0.7"/>  
    <sweepfunc:Values>  
      <sweepfunc:Value>0.7</sweepfunc:Value>  
      <sweepfunc:Value>3.7</sweepfunc:Value>  
    </sweepfunc:Values>  
  </sweep:FileAssignment>  
  <sweep:FileSweep>  
    <sweep:FileAssignment>  
      <sweep:Placeholder name="${RE}" default="5.0"/>  
      <sweepfunc:Values>  
        <sweepfunc:Value>5.0</sweepfunc:Value>  
        <sweepfunc:Value>10.0</sweepfunc:Value>  
      </sweepfunc:Values>  
    </sweep:FileAssignment>  
  </sweep:FileSweep>  
</sweep:FileSweep>
```

File

- Describes the meta information about an external file (input file)
- Contains
 - Templated file information
 - <sweep:File>
 - File location – accessible storage
 - File name
 - Provide *Prefix* and *Extension* for flexible naming

```
<xsd:complexType name="File_Type">
  <xsd:sequence>
    <xsd:element name="Location" type="xsd:string"/>
    <xsd:element name="Name" type="xsd:string"/>
  </xsd:sequence>
  <xsd:attribute name="Prefix" type="xsd:string" use="optional"/>
  <xsd:attribute name="Extension" type="xsd:string" use="optional"/>
</xsd:complexType>
```

TemplatedFile

- Describes the meta information about an external file (input file)
- Contains
 - Templated file information
 - <sweep:File>
 - File location – accessible storage
 - File name
 - Provide Prefix and extension for flexible naming
 - Sweeping type between/among parameters within an input file (like <sweep:Sweep>)
 - Serial, parallel and nested
 - <sweep:FileSweep>

```
<xsd:complexType name="TemplatedFile_Type" mixed="false">
  <xsd:sequence>
    <xsd:element ref="sweep:Parameter"/>
    <xsd:element ref="sweep:File"/>
    <xsd:element ref="sweep:FileSweep" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
</xsd:complexType>
```

Extension of Sweep Element

- Sibling to sweep:Assignment beneath sweep:Sweep

```
<Sweep>  
  <Assignment>  
  <Sweep>  
<Sweep>
```

```
<Sweep>  
  <Assignment>  
  <TemplatedFile>  
  <Sweep>  
<Sweep>
```

Extension of Sweep Element



- TemplatedFile
 - Including <sweep:Parameter> - JSDL Xpath location
 - Linking between JSDL and external file

```
<xsd:complexType name="TemplatedFile_Type" mixed="false">
  <xsd:sequence>
    <xsd:element ref="sweep:Parameter"/>
    <xsd:element ref="sweep:File"/>
    <xsd:element ref="sweep:FileSweep" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
</xsd:complexType>
```

- Sweep

```
<xsd:complexType name="Sweep_Type" mixed="false">
  <xsd:sequence>
    <xsd:element ref="sweep:Assignment" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="sweep:TemplatedFile" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="sweep:Sweep" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
</xsd:complexType>
```

```

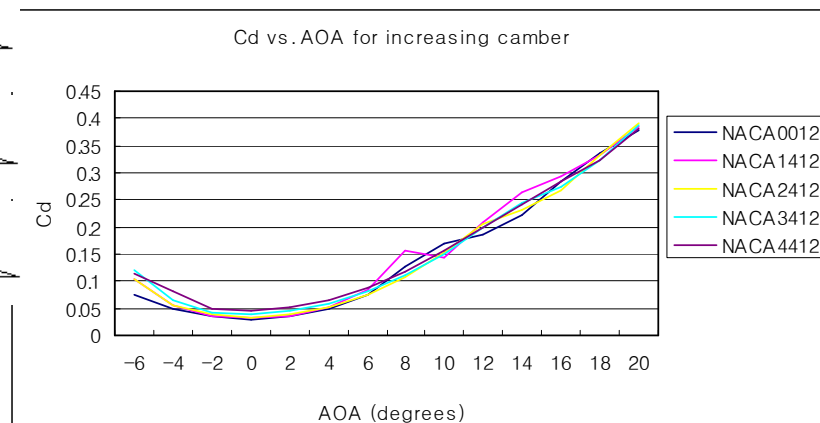
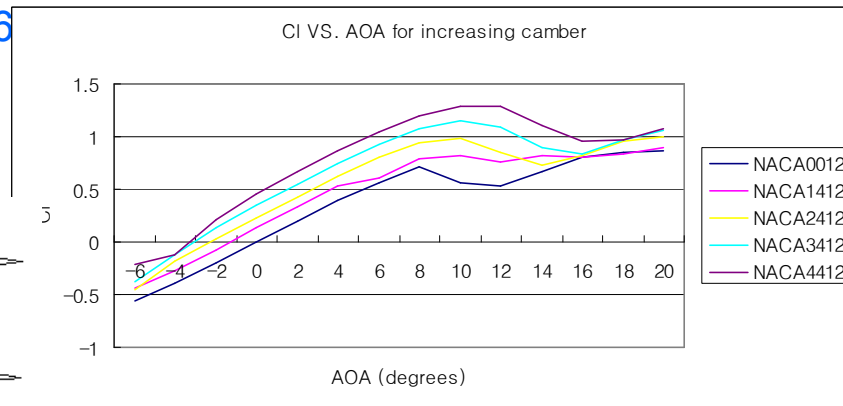
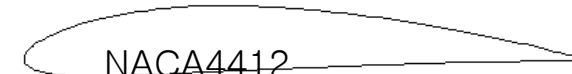
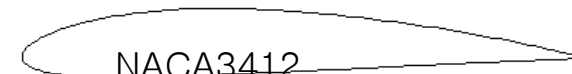
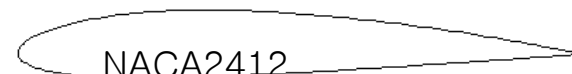
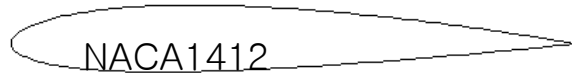
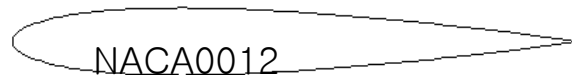
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:sweep="http://schemas.ggf.org/jsdl/2007/04/sweep" xmlns:xsd="http://www.w3.org/2001/XMLSchema" targetNamespace="http://schemas.ggf.org/jsdl/2007/04/sweep"
  elementFormDefault="qualified" version="1">
  <xsd:element name="Sweep" type="sweep:Sweep_Type"/>
  <xsd:element name="Function" abstract="true"/>
  <xsd:element name="Parameter" type="xsd:string"/>
  <xsd:element name="Assignment">
    <xsd:complexType mixed="false">
      <xsd:sequence>
        <xsd:element ref="sweep:Parameter" maxOccurs="unbounded"/>
        <xsd:element ref="sweep:Function"/>
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
  <xsd:complexType name="Sweep_Type" mixed="false">
    <xsd:sequence>
      <xsd:element ref="sweep:Assignment" minOccurs="0" maxOccurs="unbounded"/>
      <!-- the newly added element for input file parameter sweeping support -->
      <xsd:element ref="sweep:TemplatedFile" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:element ref="sweep:Sweep" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:complexType>
  <!-- Start the definition of new elements and their types -->
  <xsd:element name="TemplatedFile" type="sweep:TemplatedFile_Type"/>
  <xsd:element name="File" type="sweep:File_Type"/>
  <xsd:element name="FileSweep" type="sweep:FileSweep_Type"/>
  <xsd:element name="FileAssignment" type="sweep:FileAssignment_Type"/>
  <xsd:element name="Placeholder" type="sweep:Placeholder_Type"/>
  <xsd:complexType name="File_Type">
    <xsd:sequence>
      <xsd:element name="Location" type="xsd:string"/>
      <xsd:element name="Name" type="xsd:string"/>
    </xsd:sequence>
    <xsd:attribute name="Prefix" type="xsd:string" use="optional"/>
    <xsd:attribute name="Extension" type="xsd:string" use="optional"/>
  </xsd:complexType>
  <xsd:complexType name="TemplatedFile_Type" mixed="false">
    <xsd:sequence>
      <xsd:element ref="sweep:Parameter"/>
      <xsd:element ref="sweep:File"/>
      <xsd:element ref="sweep:FileSweep" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="FileSweep_Type" mixed="false">
    <xsd:sequence>
      <xsd:element ref="sweep:FileAssignment" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:element ref="sweep:FileSweep" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="Placeholder_Type" mixed="false">
    <xsd:attribute name="default" type="xsd:string" use="required"/>
    <xsd:attribute name="name" type="xsd:string" use="required"/>
  </xsd:complexType>
  <xsd:complexType name="FileAssignment_Type" mixed="false">
    <xsd:sequence>
      <xsd:element ref="sweep:Placeholder"/>
      <xsd:element ref="sweep:Function"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:schema>

```

sweep.xsd

Case-2

- Solver : 2D compressible
- Argument type : `-mesh mesh_name, -param param_input`
- Geometries (mesh) : `NACA0012, NACA11412, NACA2412, NACA3412, NACA4412`
- `AOA : -6, -4, -2, 0, 2, 4, 6`
- Total 70 jobs at a time



```
AMACH 0.6d0
RE 5.0d6
AOA -6.0d0
TOL 1.0d-4
TINF 290.0d0
CFL 0.5d0
IERRWRT 1
TOTPES 6
NSEULER -1
KWKEBL 0
INTWRT2 50
ITMAX2 10000
STEADINESS 0
```