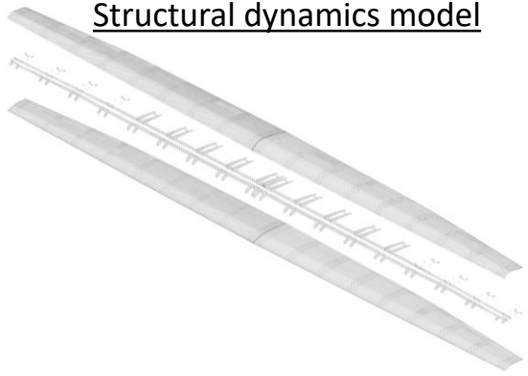
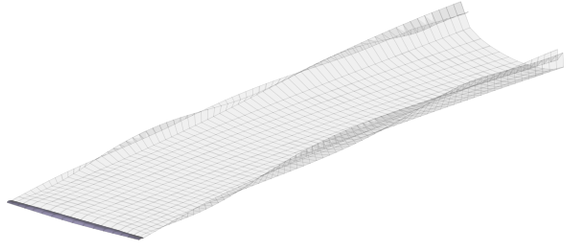
1: Fully parametrized wing model

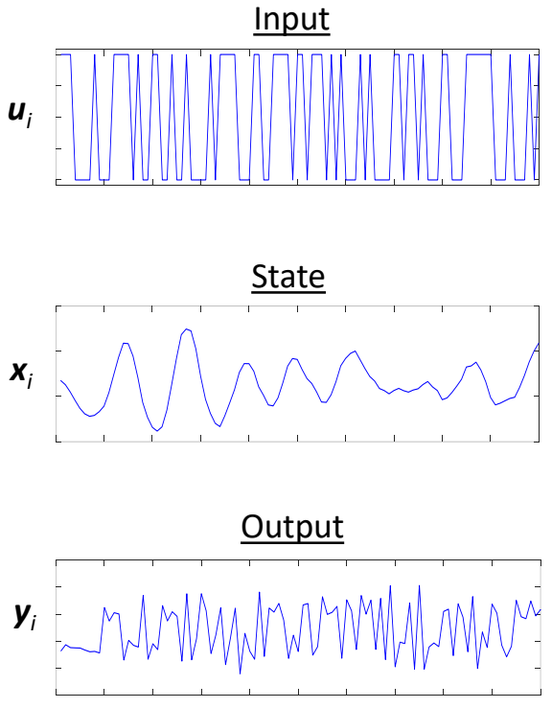
Structural dynamics model



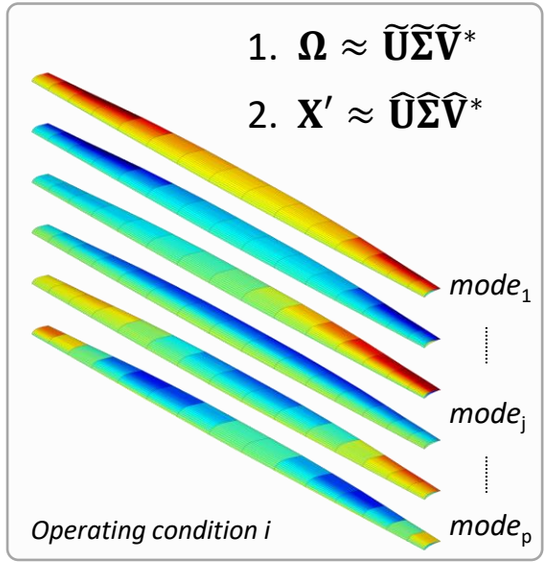
Unsteady aerodynamics model



2: FSI solver



3a: Data-driven ROM



$$\boldsymbol{q}_i^{n+1} = \widetilde{\mathbf{A}}\boldsymbol{q}_i^n + \widetilde{\mathbf{B}}\boldsymbol{u}^n + \widetilde{\mathbf{F}}\boldsymbol{u}^{n+1}$$

$$\boldsymbol{x}_i^{n+1} = \widehat{\mathbf{U}}_t \boldsymbol{q}_i^{n+1}$$

3b: Parametrized ROM

Operating condition 1

$$\boldsymbol{q}_1^{n+1} = \widetilde{\mathbf{A}}\boldsymbol{q}_1^n + \widetilde{\mathbf{B}}\boldsymbol{u}^n + \widetilde{\mathbf{F}}\boldsymbol{u}^{n+1}$$

Operating condition i

$$\boldsymbol{q}_i^{n+1} = \widetilde{\mathbf{A}}\boldsymbol{q}_i^n + \widetilde{\mathbf{B}}\boldsymbol{u}^n + \widetilde{\mathbf{F}}\boldsymbol{u}^{n+1}$$

Operating condition k

$$\boldsymbol{q}_k^{n+1} = \widetilde{\mathbf{A}}\boldsymbol{q}_k^n + \widetilde{\mathbf{B}}\boldsymbol{u}^n + \widetilde{\mathbf{F}}\boldsymbol{u}^{n+1}$$

$$\boldsymbol{F}_{aero}^{n+1} = f(\mathbf{c}_p^{n+1})$$
$$= f((\boldsymbol{q}^{n+1})^2, \boldsymbol{q}^{n+1}, \boldsymbol{q}^n, \dots)$$