**INGEGNERIA PARAMETRICA**

**1° – 2° week**

* General introduction to Grasshopper
  + List operation on simple data

Looking at the several operations

* + Create geometry in Grasshopper or import from Rhino

Case study: trave reticolare tra due generiche curve ( Section 2 AT )

* + Transformations (move, rotations, scale, orient, graph mapper)

Case study: Skyscraper design ( Section 4 AT )

* + Curve studies (Curvature, perpendicular frame, discontinuity)

Case study: Spline to Arc, a really powerful algorithm ( Section 3 AT )

* + Surface studies (Curvature, perpendicular frame, splitting)

Case study: Spatial truss ( Section 3 AT )

* + Mesh introduction

Case study: Approach to make an organic shape ( Section 6 AT )

**3° - 4° week**

* General introduction to Karamba
  + Setting-up a structural model

Line to Beam, Mesh to Shell, Material, Cross section, Load, Support

* + Post processing

Reading the results, deformation, Internal forces, report

* + Algorithm inside Karamba

2nd order theory, Natural vibrations, Bucking analyses, Tension-compression only

* + Stress Pattern on shell element

Principal stress direction, Principal moment direction, iso lines on shell

* + Structural Optimization: Single and Multi-objective optimization

Galapagos, Firefly, Octopus

**5° week**

* Geometry Gym
  + Export Grasshopper Model to other FEA software

Grasshopper to GSA/SAP, Karamba to Sap

* Interoperability Grasshopper - Excel
  + Import and export data to EXCEL

Upload CFD data set to apply to Karamba

**6° week**

* K2E, Kangaroo 2 Engineering
  + Set up a structural model able to perform non linear analyses

Beam, Bar, Cable, Prestress

* Design Explorer
  + List operation on simple data

Looking at the several operations

* + Create geometry in Grasshopper or import from Rhino

Case study: trave reticolare tra due generiche curve ( Section 2 AT )

**7° week**

* Q&A