FA.ULisboa | 2019/2020 | MGG 4F | 1st semester

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Class 1 19/Set	• Presentation of the course, URL and syllabus. • Basic concepts about surfaces, their generation and classification. **Genesis** - Point, Line, Surface, Volume **Lines** - Tangent, Normal, bi-Normal, Curvature, Radius of curvature, Osculating circle, Torsion **Surfaces** - Tangent plan, normal line, normal plan, normal section, principal normal planes, principal normal sections, mean curvature, gaussian curvature **Geometric operations** - Geometric transformations: Euclidean, affine, projective, topological, "baker" transformations - Intersections and tangencies between surfaces - Boolean operations **Surfaces classification criteria** - Curvature - Order (quadric, cubic, quartic, …) - Type of generatrix (ruled / Curved; developable / non-developable) - Type of directrix (helicoids, …) - Movement of the generatrix (translation, revolution, elliptical revolution, sweep) - Topology (open / closed, equivalent to sphere, equivalent to torus, equivalent to circle, equivalent to an annulus, …) **Types of surfaces (classes)** - Polyhedral (platonic solids, Archimedes solids) - Quadric - Revolution - Curved - Ruled | (developable | non-developable) - NURBS - Helicoids * Rhinoceros 6 can be downloaded and installed from https://www.rhino3d.com/download The trial version works for 90 days. It should be enough for the semester. After 90 days it still works but doesn't save.
Class 2 26/Set	• Presentation and preparation of Rhinoceros environment (units, tolerances, visual modes, basic commands) Exercise 1 | weight=25% • Modelling a hyperbolic paraboloid (corner points, edge curves, loft, curve network, intersections)

Class 3 3/Oct	• Curvature analysis (mean and gaussian) • Bézier curves of degree 2 as parabolas. • Modelling a hyperbolic paraboloid using a network of parabolas. • Introduction to Grasshopper (GH) • Modelling a parametric hyperbolic paraboloid with GH (Maths, Vector, Curve, Surface tabs) • Development of exercise 1
Class 4 10/Oct	• Development of exercise 1 • Lines (conic lines, helix, B-Splines with control points, B-Splines interpolating points) • Modelling surfaces (Conical, Cylindrical, Spherical, Ellipsoid, Torus, Hyperbolic paraboloid, One sheet hyperboloid of revolution, Two sheet hyperboloid of revolution, Paraboloid of revolution, Ruled Helical surface) in Rhino using different strategies (loft, sweep, curve network)
Class 5 17/Oct	• Development of exercise 1 • Modelling surfaces (Conical, Cylindrical, Spherical, Ellipsoid, Torus, Hyperbolic paraboloid, One sheet hyperboloid of revolution, Two sheet hyperboloid of revolution, Paraboloid of revolution, Ruled Helical surface) in Grasshopper using different strategies (loft, sweep, curve network) • GH environment • GH Parameters tab: - input components (slider, knob, panel) - utility components (scribble) • GH Maths tab: - operator components (addition, subtraction, multiplication, division) - script components (expression) - trigonometry components (degree to radians) • GH Sets tab: - List components (list item, reverse list) - Sequence components (series) - Tree components (flatten tree, flip matrix) • GH Vector tab: - Plane components (XY, YZ, XZ) - Point components (construct point, distance) - Vector components (unit vectors, vector from two points) • GH Curve tab: - Division components (curve division in equal length segments) - Primitive components (line, circle, arc, ellipse) - Spline components (interpolate) • GH Surface tab: - Freeform components (edge surface, loft, surface network, ruled surface) • GH Transform tab: - Array components (polar array) - Euclidean components (move, rotate, mirror) • GH bake operation