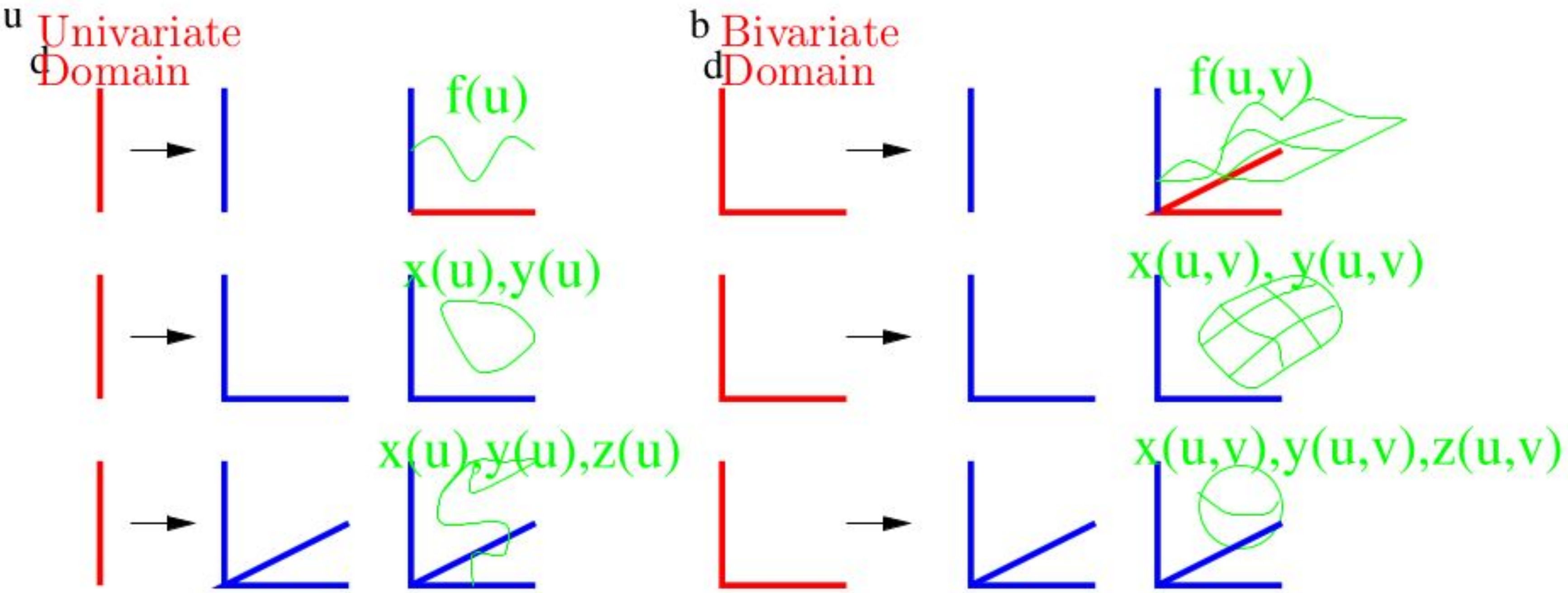
Maps and Curved Geometry

Domain, Range and Maps



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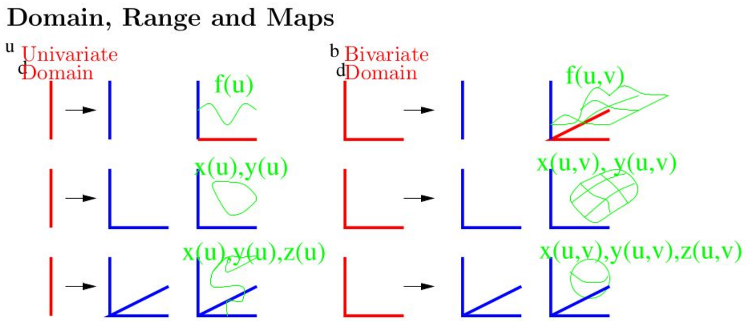

Related Concepts

- Graph of a function
- 1-Manifold ~ curve
- 2-Manifold ~ surface

- Scalar field: R^3 → R^1 Each point in 3-space is assigned a scalar
- Vector field: R^3 → R^3 ...a vector
- Tensor field: R^3 → R^3×3 ...a tensor

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Polynomials and Polynomial Forms

Polynomial of degree n :-
an infinitely differentiable map whose nth derivative is constant

Polynomial p in of degree d in Bernstein-Bézier form **(BB-form)**

$$p := \sum_{i+j=d} c(i) B_{j,i}, \qquad \text{where } B_{j,i}(u) = \frac{d!}{i!j!} u^i (1-u)^j$$

Typically, p is evaluated on the interval [0, 1]. This yields a polynomial piece.

Curve editor https://www.desmos.com/calculator/ebdtbxgbq0

http://en.wikipedia.org/wiki/B%C3%A9zier_curve

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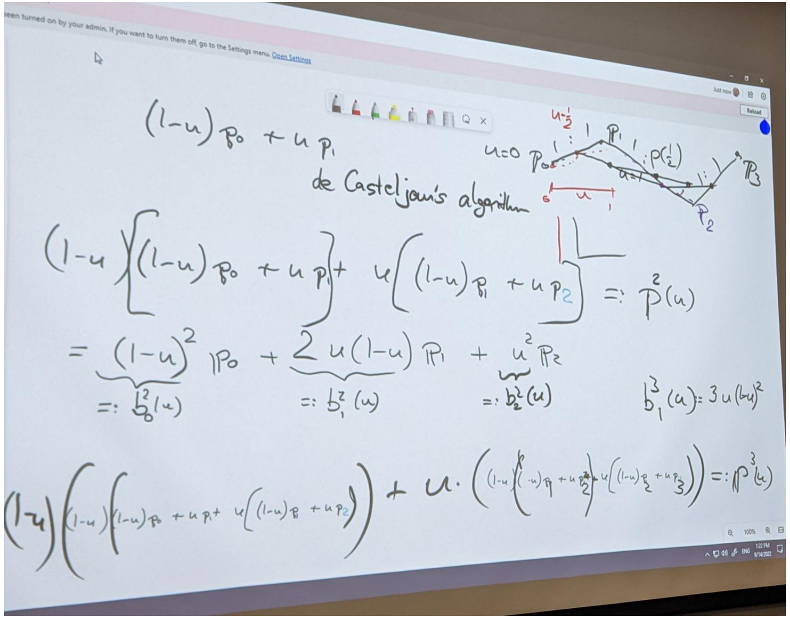
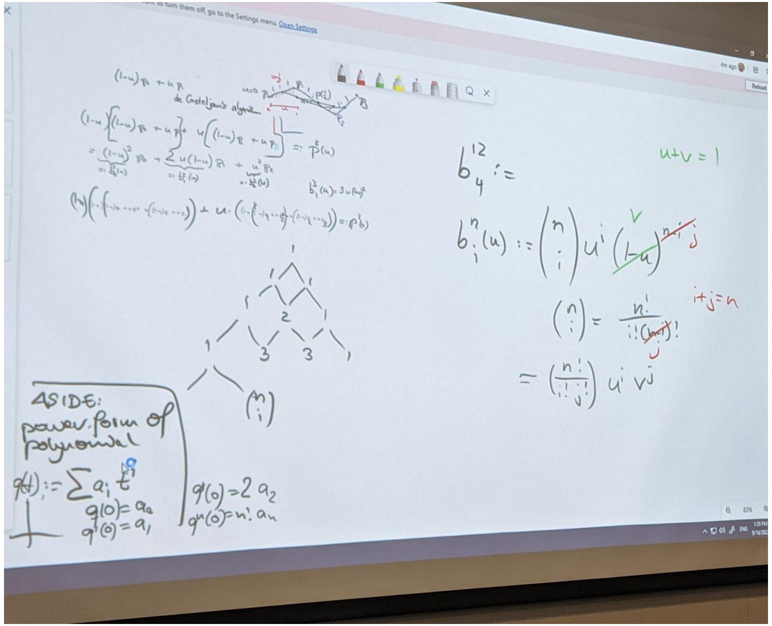
Computer Graphics   Jorg Peters





Maps and Curved Geometry

Piecewise polynomials in B-spline form (B-form)
Industry uses the acronym NURBS = Non-uniform rational B-spline

Uniform splines can be efficiently evaluated by subdivision.

Spline = piecewise polynomial (function).
Knots delineate the break points between polynomial pieces.
Typically some smoothness is enforced between the pieces.
A spline can be represented in Bézier form by connecting pieces in Bézier form.
A spline can be represented in B-spline form.