matfyz

Computer Graphics Charles University

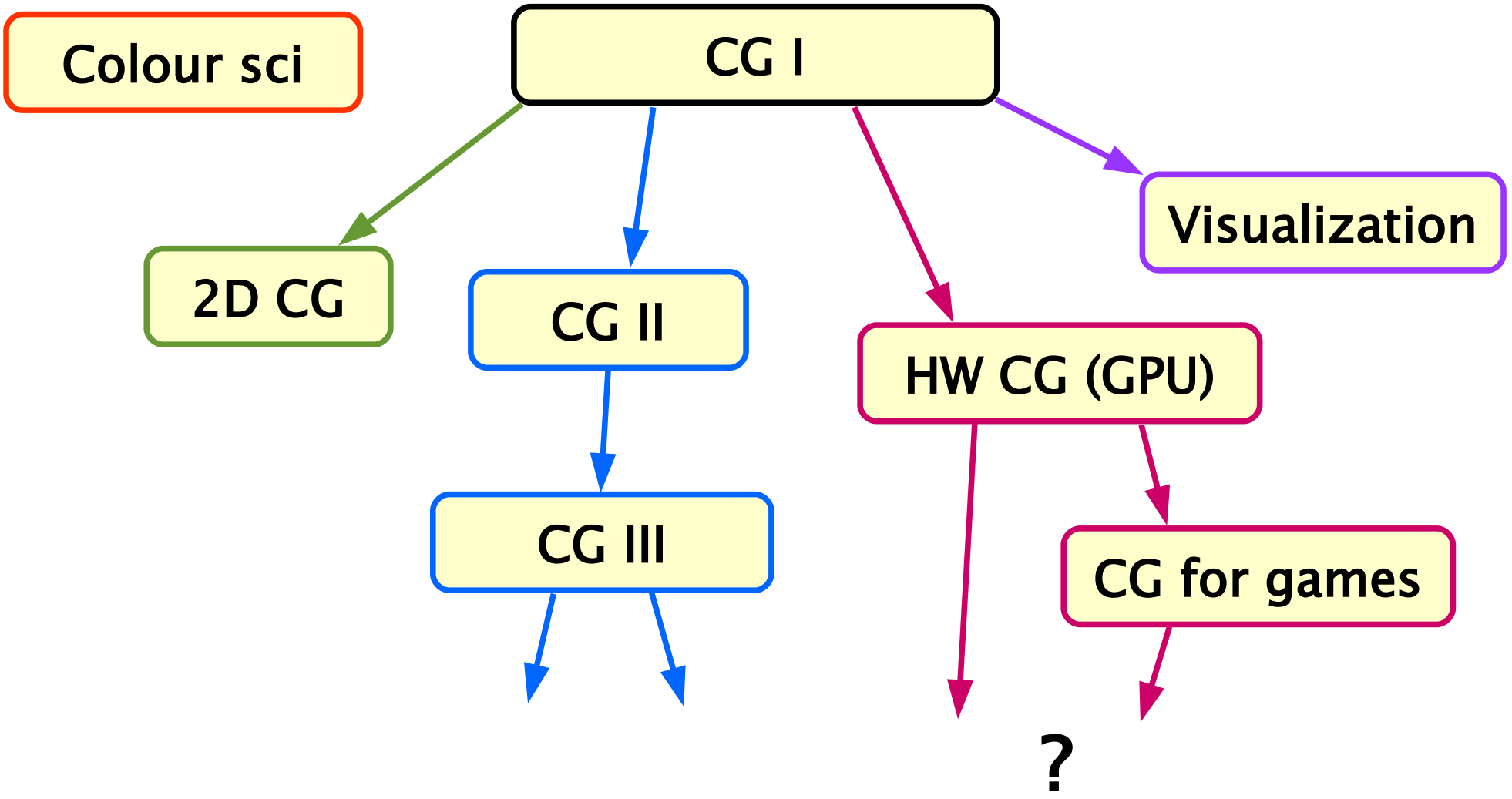
CG curriculum as of 2016

CGG MFF UK Praha

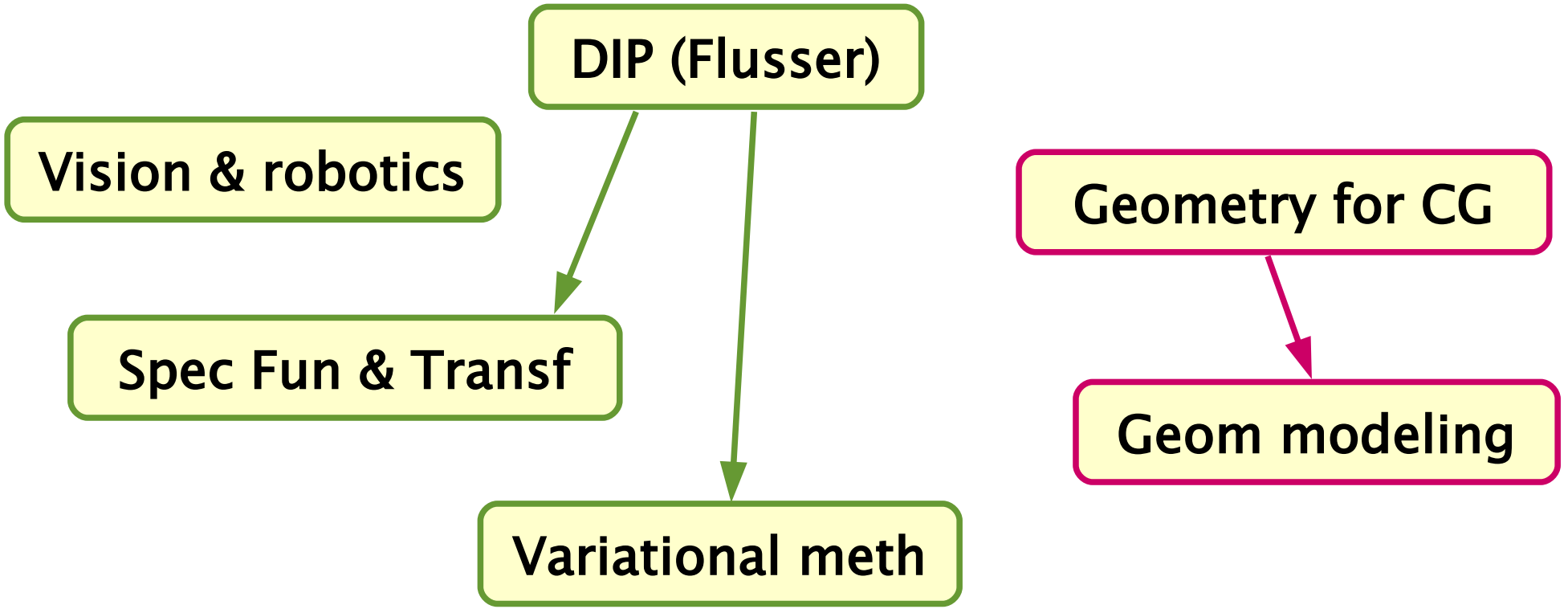
info@cgg.mff.cuni.cz

http://cgg.mff.cuni.cz/

Status Quo (2014–2016)



Status Quo (2014–2016) continued



Computer graphics I (NPGR003)

- **survey CG course**
  - 2nd - 3rd year of study, even for non-computer scientists
  - introduction to 2D and 3D graphics, independent

- raster and vector graphics, colors, transparency, HDR
- filters, color/gray reproduction, image coding & formats
- rasterization basics
- fundamental math for 3D graphics, homogeneous coordinates, matrices, projections
- 3D scene representations, scene hierarchy, simple rendering, visibility, shading
- GPU architecture and elementary OpenGL (including practice)

Computer graphics II (NPGR004)

- **rendering basics**
  - 2nd - 3rd year of study, follows the CG1
  - ray-based rendering

- more lighting models, models based on microfacets, shading
- elementary ray-tracing, ray-scene intersections, speed-up
- texturing, 2-3D textures, procedural & noise-based textures
- anti-aliasing and distributed ray-tracing
- Monte-Carlo rendering basics, rendering and global illumination theory, contemporary trends
- FEM approach to global illumination: radiosity

Hardware for CG (NPGR019)

- **GPU support for realtime CG (RTCG)**
  - 2nd - 3rd year of study, follows the CG1
  - realtime 3D graphics, GPUs, GPU programming (shaders)

- GPU architecture and history, fixed-functionality pipeline
- math for RTCG, quaternions, spline curves for animation
- data for GPU, textures, GPU buffers, vertex attributes, ..
- data optimizations, level-of-detail, billboards, imposters
- GPU shaders: vertex, fragment, tessellation, geometry
- OpenGL system (practice), GLSL language, advanced OpenGL techniques (GL ≥ 3.0)
- GPGPU basics, CUDA, OpenCL

Advanced 2D CG (NPGR007)

- **advances of 2D raster graphics**
  - ≥3rd year of study, follows the CG1
  - geometric image transforms, image/video compression

- raster image transforms, α-blending, warping, morphing
- spatial data structures in 2-3D, BVH, R-tree, KD-tree, ..
- still image compression, theory, quantization, predictive, transform, hybrid methods, JPEG standards, JFIF
- video compression, motion compensation, stream hierarchy, standards: H.261, MPEG-*, H.264/AVC
- advanced image transforms, wavelets and lifting (briefly)

Visualization (NPGR023)

- **visualization**
  - ≥3rd year of study, follows the CG1
  - data visualization in 2-3D, interactive WWW visualization

- general data visualization, tensor (high-dim) data, vector fields
- medical data acquisition (CT, MRI, MRS, PET, SPECT)
- volume data visualization, isosurfaces, ray-based volume rendering, transfer functions, realtime optimizations (GPU)
- flow-field visualization
- WWW visualization - “Data Driven Documents”, d3.js library architecture, selections, data joins, transitions, interactivity

Future .. ?

- intrinsic **image analysis** course[s]
  - image processing, recognition, ..
- **animation** course ?
- **physically-based simulations**
  - rigid body, articulated hierarchy, inv. kinematics, fluid dyn.
- **computational geometry**
  - Ivana Kolingerová (ZČU), KAM MFF?
- work in **3D modeling program** (is it worth a course?)
  - 3DS MAX, Blender, Rhinoceros
- **3D printing** (is it worth a course?)
- modern **VR technologies** (Oculus etc.) ?