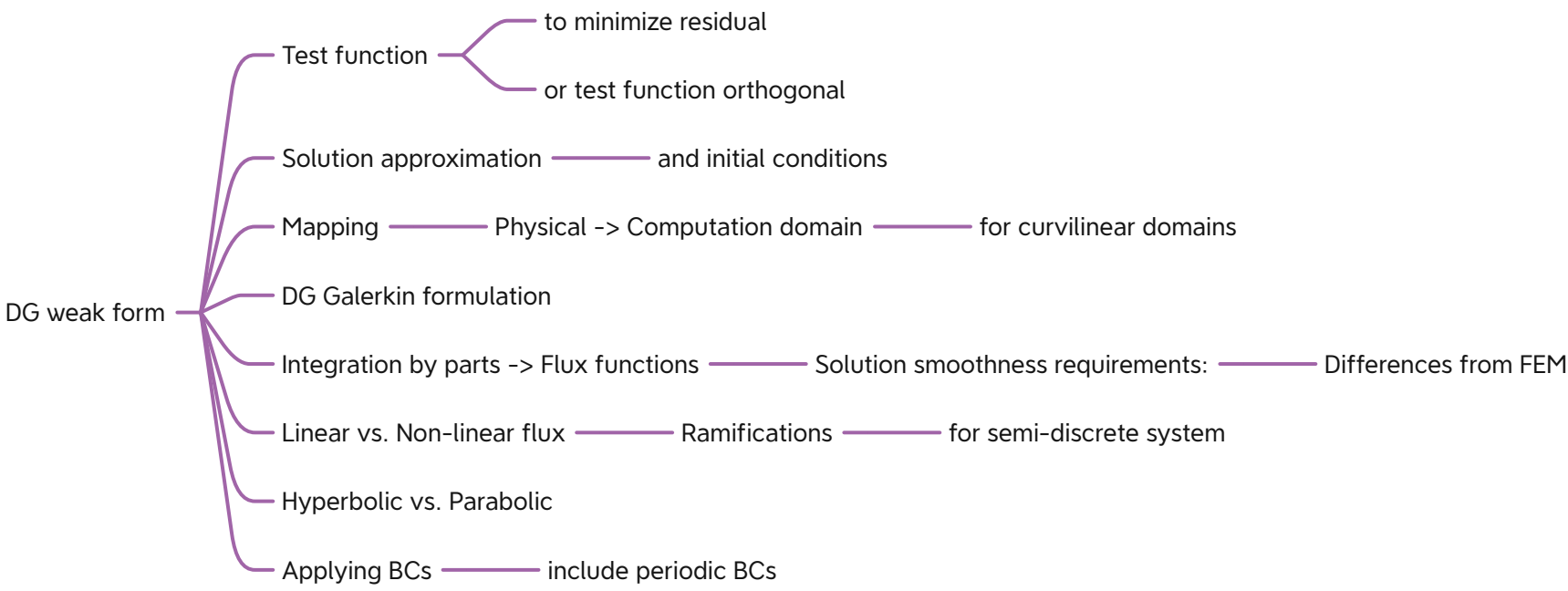


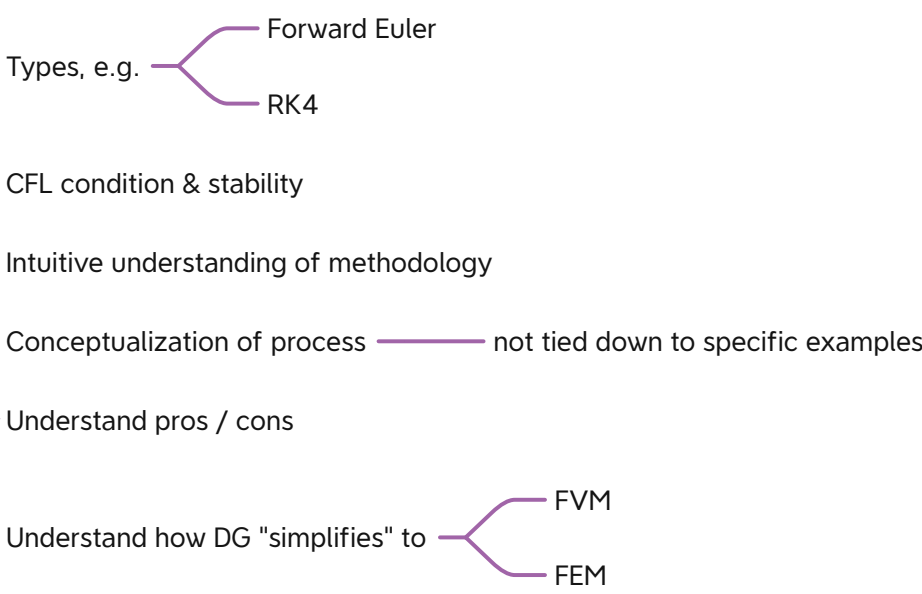
Lecture Goals

Understand DG spatial discretization (advective)



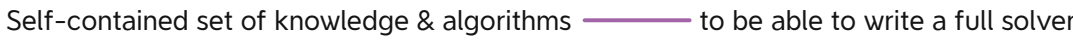
Understand time discretization

Method of lines style semi-discrete form



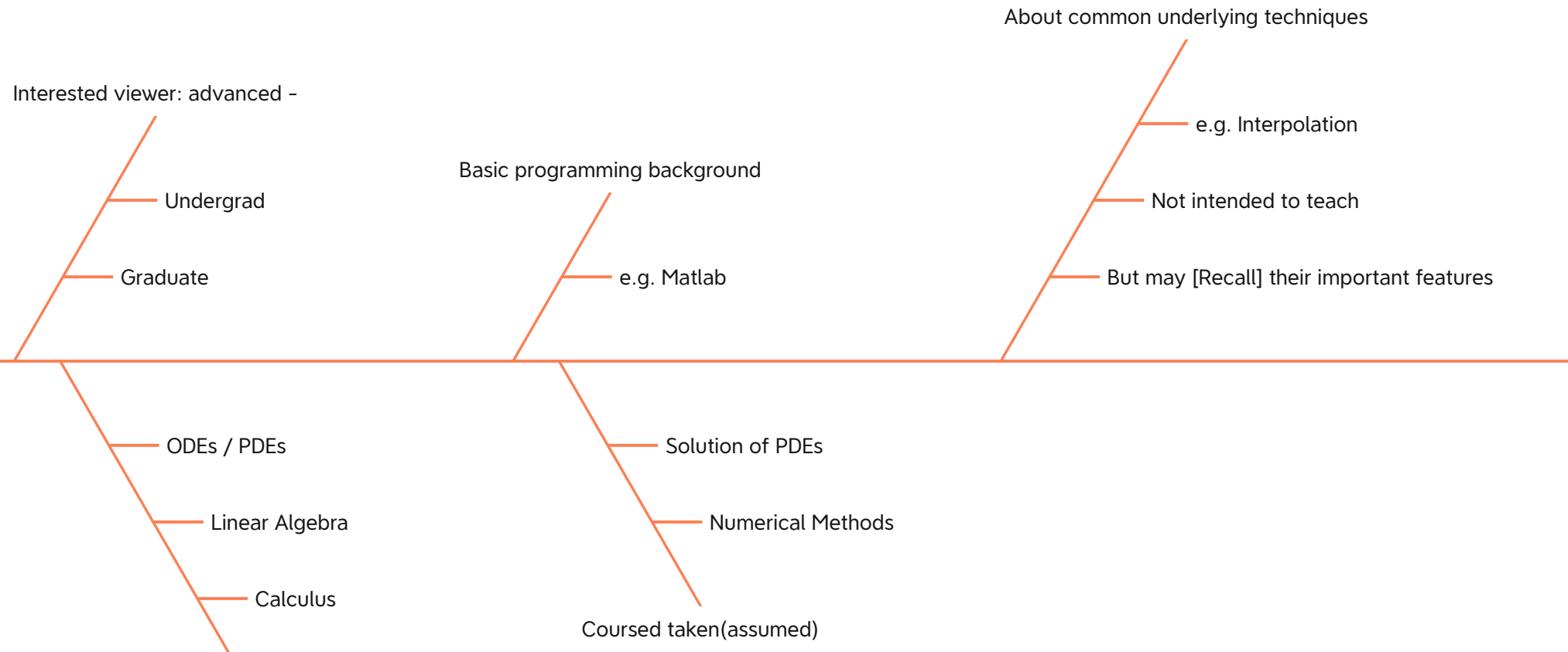
Learn how to apply DG to arbitrary PDEs & realm of applicability

Generate runnable code of your own

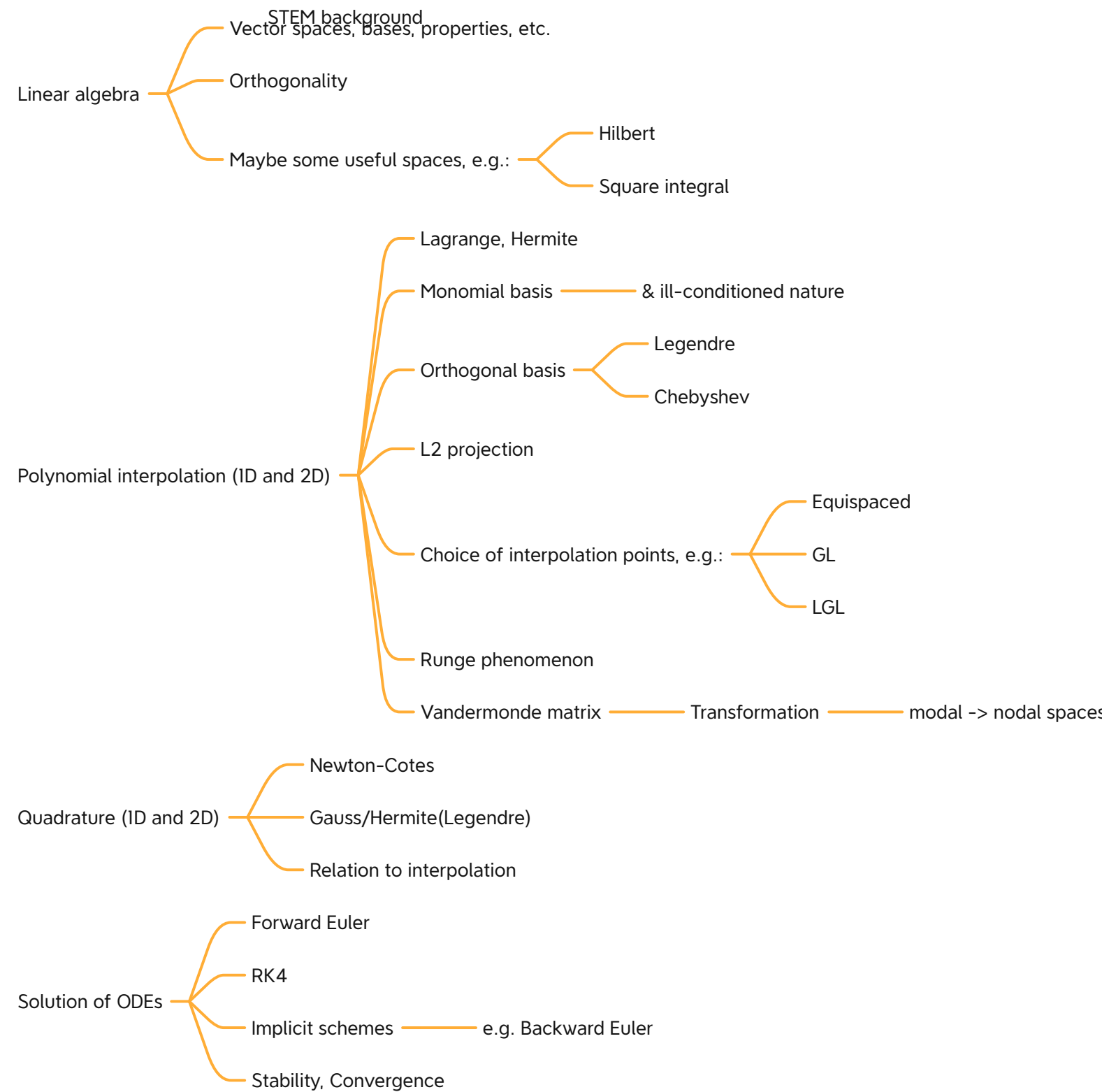


Overall Content Structure

Assumed Prerequisite Knowledge



Numerical Methods Prerequisites



Topics Layout				
	Module 1: What is DG?	Module 2: A Simple 1D DG Solver	Module 3: To Higher-Orders (nodal) 3A: Sol'n Approximation	Module 3: To Higher-Orders (nodal) 3B: Discrete System
	DG motivation (why vs. FEM, FVM, FDM)	Linear solution approximation	Revisit weak form	Numerical Quadrature (Gauss)
		Test function choice (Galerkin)	Approx. space	Hermite interpolation (2N+1 quad)
	Scalar conservation law (linear) PDE	Upwind flux	L2 Projection minimizes residual norm	Truncation error/exact quadrature
		Mass Matrix	Test space -> orthogonal	GL Lagrange orthogonality
	Weak form derivation	Stiffness Matrix	Monomial basis?	Local differentiation
		Putting it all together (linear system)	Ill-conditioning of monomials	Flux interpolation
	Global domain vs. local element	Semi-discrete system	Recall: Lagrange interpolation (code)	Stiffness Integral
		Forward Euler	Derive Lagrange spatial approximation	Numerical Flux (interpolated)
	Multiple-valued element boundaries	Investigate h-convergence	Equispaced interp points?	Assembly of system
		Investigate t-convergence	Runge phenomenon	RK4 time discretization
	Recall: Flux functions	Investigate stability (CFL)	Why: Bernstein/Markov inequality	
			Roots of Leg instead	Investigate p-convergence (smoothness reqs)

A Pedagogical Comment				
	Take advantage of format	Each section may have subsections but overall section is intended to be a self-contained concept.	Easy to "zone-out", before the start of new section	Each Module has a larger self-contained concept.
	replay	First slide of a new section	try and put what you learned into action:	Should be able to put together a script
	pause			
	speed up	has the title format Section: Subsection	Make a code snippet <ul style="list-style-type: none">to test your understandingor verify a claimed result etc.	that accomplishes something substantial!
	slow down			

Solutions of PDEs Prerequisites		
Domain representation	Meshing	
	BCs	Neumann
		Dirichlet
Finite Difference Methods (FDM)	Pointwise spatial derivatives	
	Computational vs. Physical domains	
	Basic mapping (bilinear)	
Finite Volume Methods (FVM)	Flux functions	
	Artificial viscosity	
	Linear vs. Non-linear fluxes	
Finite Element Methods (FEM)	Weak and strong form formulation	
	Piecewise linear solution approximation	
	Galerkin style test functions	
	Local support	