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Block Structured Mesh

BlockMesh.cs

Two 2nd rank tensors serve as storage for node variable values (node vars):

$\mathbf{u}_{\triangleright}$	$u^{jl}_{\triangleright}$	Tensor Uf	`free node vars` ,
$\mathbf{u}_{\triangleleft}$	$u^{jl}_{\triangleleft}$	Tensor Uc	`constrained node vars` .

First slot (j) signifies node position, while the second (l) marks a dependent variable. For both tensors the first slot's dimension is N (nodes) while the second slot's dimension is m (vars). The two tensors hold mutually exclusive information - if the component $u^{5,4}$ appears in $\mathbf{u}_{\triangleright}$, it cannot appear in $\mathbf{u}_{\triangleleft}$ because a variable is either constrained or it isn't.

The sum of them thus produces a tensor which holds all values:

$\mathbf{u}_{\bowtie} = \mathbf{u}_{\triangleright} + \mathbf{u}_{\triangleleft}$ double U `all = free + constrained` .

Here U is a method that can access values from both Uf and Uc - it retrieves the value from the correct source. A third 2nd rank tensor stores all forcing vars (right-hand side od `PDE`):

$\mathbf{f}_{\bowtie}$	$f^{jl}_{\bowtie}$	Tensor F	`forcing vars` .

. The dynamic parameters at a point in time are stored ina rank 4 tensor **A** also known as the stiffness matrix:

A	A^{iphl}	Tensor A	`stiffness matrix` .

Triple overlap integrals reside in a rank 7 tensor **S**, while double overlap integrals reside in a rank 5 tensor **T**:

S	$S_{\varepsilon\beta\alpha p\gamma\delta q}$	Tensor S	`tripple overlap integrals` ,
T	$T_{\varepsilon\beta\alpha p\delta}$	Tensor T	`double overlap integrals` ,

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Assembly process:

$$\sum_{i,j}^{N} v_{\triangleright}^{ik} \sum_{\varepsilon}^{n} \sum_{\substack{\alpha,\delta \ni: \\ (\varepsilon,\alpha)=i \\ (\varepsilon,\delta)=j}}^{12} \left(S_{\varepsilon\beta\alpha p\gamma\delta q} A^{(\varepsilon,\beta)p}{}_{hk} A^{(\varepsilon,\gamma)qhl} u_{\triangleright}^{(\varepsilon,\delta)l} \right) =$$

$$\sum_{i}^{N} v_{\triangleright}^{ik} \sum_{\varepsilon}^{n} \sum_{\substack{\alpha \ni: \\ (\varepsilon,\alpha)=i}}^{12} \left(T_{\varepsilon\beta\alpha p\delta} A^{(\varepsilon,\beta)p}{}_{hk} f_{\bowtie}^{(\varepsilon,\delta)h} - S_{\varepsilon\beta\alpha p\gamma\delta q} A^{(\varepsilon,\beta)p}{}_{hk} A^{(\varepsilon,\gamma)qhl} u_{\triangleleft}^{(\varepsilon,\delta)l} \right) .$$