**LECTURE ASSIGNMENT 1**

Verify by direct calculation the weighted residual expression for the first derivative



for a regular grid of spacing . In a line segment of end points  and , the non-zero linear shape functions and the interpolant  are given by

 and .

Place the origin of the coordinate system at point .

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As the shape function  is non-zero only in the line segments having the point  in common and origin is placed at point , it is enough to consider . Using the expressions of the shape functions in line segments  and 

:  and  

,  , and 

:  and  

,  , and 

Integral over the domain is the sum of the integrals over the line segments. Direct calculation gives first

 and 

and, after that, combining the integrals over the line segment having the point  in common ( vanishes elsewhere):

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