

$$\langle \tilde{\mathbf{q}}_1, \tilde{\mathbf{q}}_2 \rangle_g = \int_{\Omega} \left( \frac{1}{g} \tilde{u}_1 \tilde{u}_2 + \frac{1}{g^3} \tilde{v}_1 \tilde{v}_2 \right) dx dy$$