```
<< AceGen`
SMSInitialize["mls3dstrainssecondkernel",
 "Language" → "Fortran90", "Mode" → "Optimal", "VectorLength" → 50 000]
SMSModule["mls3dstrainssecondkernel",
  Real[mu$$, lambda$$, c2$$, c3$$, c5$$, c11$$, c15$$, nl$$[3], nk$$[3], nl2$$[3, 3],
   nk2$$[3, 3], f$$[3, 3], f2$$[3, 3, 3], s$$[3, 3], sigma$$[3, 3, 3], kernel$$[3, 3]]];
mu ⊨ SMSReal[mu$$];
lambda ⊨ SMSReal[lambda$$];
c2 ⊨ SMSReal[c2$$];
c3 ⊨ SMSReal[c3$$];
c5 ⊨ SMSReal[c5$$];
c11 ⊨ SMSReal[c11$$];
c15 ⊨ SMSReal[c15$$];
nl ⊨ SMSReal[Array[nl$$, {3}]];
nk ⊨ SMSReal[Array[nk$$, {3}]];
nl2 ⊨ SMSReal[Array[nl2$$, {3, 3}]];
nk2 ⊨ SMSReal[Array[nk2$$, {3, 3}]];
f ⊨ SMSReal[Array[f$$, {3, 3}]];
f2 ⊨ SMSReal[Array[f2$$, {3, 3, 3}]];
s ⊨ SMSReal[Array[s$$, {3, 3}]];
sigma ⊨ SMSReal[Array[sigma$$, {3, 3, 3}]];
kernel ⊨ SMSReal[Array[kernel$$, {3, 3}]];
delta = {{1, 0, 0}, {0, 1, 0}, {0, 0, 1}};
(* Fourth order tensor *)
cc = Table[0, {i, 3}, {j, 3}, {k, 3}, {l, 3}];
Do[cc[[i, j, k, l]] = lambda * delta[[i, j]] * delta[[k, l]] +
     mu * (delta[[i, k]] * delta[[j, l]] + delta[[i, l]] * delta[[j, k]]), {i, 3}, {j, 3}, {k, 3}, {l, 3}];
(* Sixth order tensor *)
ctang = Table[0, {i, 3}, {j, 3}, {k, 3}, {l, 3}, {p, 3}, {q, 3}];
Do[ctang[[i, j, k, l, p, q]] = ctang[[i, j, k, l, p, q]] +
     c2 * (delta[[i, j]] * delta[[k, l]] * delta[[p, q]] + delta[[i, j]] * delta[[k, p]] * delta[[l, q]] +
        delta[[i, k]] * delta[[j, q]] * delta[[l, p]] + delta[[i, q]] * delta[[j, k]] * delta[[l, p]]) +
     c3 * delta[[i, j]] * delta[[k, q]] * delta[[l, p]] +
     c5 * (delta[[i, k]] * delta[[j, l]] * delta[[p, q]] + delta[[i, k]] * delta[[j, p]] * delta[[l, q]] +
        delta[[i, l]] * delta[[j, k]] * delta[[p, q]] + delta[[i, p]] * delta[[j, k]] * delta[[l, q]]) +
     c11 * (delta[[i, p]] * delta[[j, l]] * delta[[k, q]] + delta[[l, i]] * delta[[p, j]] * delta[[k, q]]) +
     c15 * (delta[[i, l]] * delta[[j, q]] * delta[[k, p]] + delta[[i, p]] * delta[[j, q]] * delta[[k, l]] +
        delta[[i, q]] * delta[[j, l]] * delta[[k, p]] + delta[[i, q]] * delta[[j, p]] * delta[[k, l]]),
  {i, 3}, {j, 3}, {k, 3}, {l, 3}, {p, 3}, {q, 3}];
Do[kernel[[i, j]] = 0, {i, 3}, {j, 3}];
(*s[[i,j]]*(nl[[i]]*f[[m,j]]+nl[[j]]*f[[m,i]])*)
```

```
Do[kernel[[m1, m2]] = kernel[[m1, m2]] + (1 / 4) * cc[[i1, j1, i2, j2]] *
     (nl[[i1]] * f[[m1, j1]] + nl[[j1]] * f[[m1, i1]]) * (nk[[i2]] * f[[m2, j2]] + nk[[j2]] * f[[m2, i2]]),
  {m1, 3}, {i1, 3}, {j1, 3}, {m2, 3}, {i2, 3}, {j2, 3}]
Do[kernel[[m1, m2]] = kernel[[m1, m2]] +
    (1 / 4) * ctang[[i1, j1, n1, i2, j2, n2]] * (nl2[[i1, n1]] * f[[m1, j1]] + nl2[[j1, n1]] * f[[m1, i1]] +
        nl[[j1]] * f2[[m1, i1, n1]] + nl[[i1]] * f2[[m1, j1, n1]]) * (nk2[[i2, n2]] * f[[m2, j2]] +
        nk2[[j2, n2]] * f[[m2, i2]] + nk[[j2]] * f2[[m2, i2, n2]] + nk[[i2]] * f2[[m2, j2, n2]]),
  {m1, 3}, {n1, 3}, {i1, 3}, {j1, 3}, {m2, 3}, {n2, 3}, {i2, 3},
  {j2, 3}]
Do[
  kernel[[m1, m2]] = kernel[[m1, m2]] + delta[[m1, m2]] * (1 / 2) * s[[i, j]] * (nl[[i]] * nk[[j]] + nl[[j]] * nk[[i]]),
  {m1, 3}, {m2, 3}, {i, 3}, {j, 3}]
Do[kernel[[m1, m2]] = kernel[[m1, m2]] + delta[[m1, m2]] * (1 / 2) * sigma[[i, j, n]] *
     (nl2[[i, n]] * nk[[j]] + nk2[[i, n]] * nl[[j]] + nl[[i]] * nk2[[j, n]] + nk[[i]] * nl2[[j, n]]),
  {m1, 3}, {m2, 3}, {i, 3}, {j, 3}, {n, 2}]
SMSExport[kernel, kernel$$];
SMSWrite[];
```

Out[ ]=

True

File:	mls3dstrainssecondkernel.f90	Size: 26 396
Methods	No.Formulae	No.Leafs
mls3dstrainssecondkernel	603	12 424