ma00aa

Calculates volume integrals of Chebyshev polynomials and metric element products.

[called by: dforce.] [calls: metrix.]

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1. The following quantities are calculated:

$$\texttt{DToocc(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \cos\alpha_j \tag{1}$$

$$\texttt{DToocs(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \sin\alpha_j \tag{2}$$

$$\texttt{DToosc(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \cos\alpha_j \tag{3}$$

$$\texttt{DTooss(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \sin\alpha_j \tag{4}$$

$$\texttt{TTsscc(l,p,i,j)} \equiv \int ds\, \overline{T}_{l,i}\, \overline{T}_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \cos\alpha_j\; \bar{g}_{ss} \tag{5}$$

$$\texttt{TTsscs(l,p,i,j)} \equiv \int ds\, \overline{T}_{l,i}\, \overline{T}_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \sin\alpha_j\; \bar{g}_{ss} \tag{6}$$

$$\texttt{TTsssc(l,p,i,j)} \equiv \int ds\, \overline{T}_{l,i}\, \overline{T}_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \cos\alpha_j\; \bar{g}_{ss} \tag{7}$$

$$\texttt{TTssss(l,p,i,j)} \equiv \int ds\, \overline{T}_{l,i}\, \overline{T}_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \sin\alpha_j\; \bar{g}_{ss} \tag{8}$$

$$\texttt{TDstcc(l,p,i,j)} \equiv \int ds\, \overline{T}_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \cos\alpha_j\; \bar{g}_{s\theta} \tag{9}$$

$$\texttt{TDstcs(l,p,i,j)} \equiv \int ds\, \overline{T}_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \sin\alpha_j\; \bar{g}_{s\theta} \tag{10}$$

$$\texttt{TDstsc(l,p,i,j)} \equiv \int ds\, \overline{T}_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \cos\alpha_j\; \bar{g}_{s\theta} \tag{11}$$

$$\texttt{TDstss(l,p,i,j)} \equiv \int ds\, \overline{T}_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \sin\alpha_j\; \bar{g}_{s\theta} \tag{12}$$

$$\texttt{TDstcc(l,p,i,j)} \equiv \int ds\, \overline{T}_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \cos\alpha_j\; \bar{g}_{s\zeta} \tag{13}$$

$$\texttt{TDstcs(l,p,i,j)} \equiv \int ds\, \overline{T}_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \sin\alpha_j\; \bar{g}_{s\zeta} \tag{14}$$

$$\texttt{TDstsc(l,p,i,j)} \equiv \int ds\, \overline{T}_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \cos\alpha_j\; \bar{g}_{s\zeta} \tag{15}$$

$$\texttt{TDstss(l,p,i,j)} \equiv \int ds\, \overline{T}_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \sin\alpha_j\; \bar{g}_{s\zeta} \tag{16}$$

$$\texttt{DDstcc(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \cos\alpha_j\; \bar{g}_{\theta\theta} \tag{17}$$

$$\texttt{DDstcs(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \sin\alpha_j\; \bar{g}_{\theta\theta} \tag{18}$$

$$\texttt{DDstsc(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \cos\alpha_j\; \bar{g}_{\theta\theta} \tag{19}$$

$$\texttt{DDstss(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \sin\alpha_j\; \bar{g}_{\theta\theta} \tag{20}$$

$$\texttt{DDstcc(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \cos\alpha_j \; \bar{g}_{\theta\zeta} \tag{21}$$

$$\texttt{DDstcs(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \sin\alpha_j \; \bar{g}_{\theta\zeta} \tag{22}$$

$$\texttt{DDstsc(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \cos\alpha_j \; \bar{g}_{\theta\zeta} \tag{23}$$

$$\texttt{DDstss(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \sin\alpha_j \; \bar{g}_{\theta\zeta} \tag{24}$$

$$\texttt{DDstcc(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \cos\alpha_j \; \bar{g}_{\zeta\zeta} \tag{25}$$

$$\texttt{DDstcs(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \cos\alpha_i \sin\alpha_j \; \bar{g}_{\zeta\zeta} \tag{26}$$

$$\texttt{DDstsc(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \cos\alpha_j \; \bar{g}_{\zeta\zeta} \tag{27}$$

$$\texttt{DDstss(l,p,i,j)} \equiv \int ds\, \overline{T}'_{l,i}\, \overline{T}'_{p,j} \oint\!\!\oint d\theta d\zeta \;\; \sin\alpha_i \sin\alpha_j \; \bar{g}_{\zeta\zeta} \tag{28}$$

where $\overline{T}_{l,i} \equiv T_l\, \bar{s}^{m_i/2}$ if the domain includes the coordinate singularity, and $\overline{T}_{l,i} \equiv T_l$ if not; and $\bar{g}_{\mu\nu} \equiv g_{\mu\nu}/\sqrt{g}$.

2. The double-angle formulae are used to reduce the above expressions to the Fourier harmonics of $\bar{g}_{\mu\nu}$: see `kija` and `kijs`, which are defined in preset.