

$$\mathbb{E} \left[\mathbf{a}_k \alpha_i + \mathbf{a}_k \alpha_j + \mathbf{b}_k \beta_i + \mathbf{b}_k \beta_j, \frac{\mathbf{1}}{\mathcal{A}_i \mathcal{A}_j} \right. \\
\left. (\mathbf{y}_k \mathcal{A}_i \mathcal{A}_j \eta_i + \mathbf{y}_k \mathcal{A}_j \eta_j + \mathbf{x}_k \mathcal{A}_i \xi_i + \mathcal{A}_i \mathcal{A}_j \eta_j \xi_i - \right. \\
\left. \mathbf{B}_k \mathcal{A}_i \mathcal{A}_j \eta_j \xi_i + \mathbf{x}_k \mathcal{A}_i \mathcal{A}_j \xi_j) \right], \mathbf{1} + \frac{\mathbf{1}}{4 \mathcal{A}_i \mathcal{A}_j} \\
\left(-4 \mathbf{y}_k \mathcal{A}_j \beta_i \eta_j - 4 \mathbf{x}_k \mathcal{A}_i \beta_j \xi_i + 4 \mathbf{x}_k \mathbf{y}_k \eta_j \xi_i + 4 \mathbf{a}_k \mathbf{B}_k \mathcal{A}_i \mathcal{A}_j \eta_j \xi_i + \right. \\
\left. 2 \mathbf{y}_k \mathcal{A}_j \eta_j^2 \xi_i - 6 \mathbf{B}_k \mathbf{y}_k \mathcal{A}_j \eta_j^2 \xi_i + 2 \mathbf{x}_k \mathcal{A}_i \eta_j \xi_i^2 - 6 \mathbf{B}_k \mathbf{x}_k \mathcal{A}_i \eta_j \xi_i^2 + \right. \\
\left. \mathcal{A}_i \mathcal{A}_j \eta_j^2 \xi_i^2 - 4 \mathbf{B}_k \mathcal{A}_i \mathcal{A}_j \eta_j^2 \xi_i^2 + 3 \mathbf{B}_k^2 \mathcal{A}_i \mathcal{A}_j \eta_j^2 \xi_i^2 \right) \epsilon + \mathbf{O}[\epsilon]^2 \left. \right]$$