$$\lhd\!\times\underbrace{\overgroup{\dot z_z\underline{E}}\,\overgroup{\ddot z_z\underline{E}}}\rhd = \underbrace{\overgroup{\dot z_z\underline{E}}}\lhd\!\times\underbrace{\overgroup{\ddot z_z\underline{E}}}\rhd$$

$$= \underbrace{\overset{*}{\overgroup{\dot z\,{}_z\underline{\hat g}}}\,{}_oE\,{}_z\hat g\lhd + {}_z\hat g^*\,{}_oE\,\overgroup{\dot z\,{}_z\underline{\hat g}}}\lhd\!\times\underbrace{\overset{*}{\overgroup{\ddot z\,{}_z\underline{\hat g}}}\,{}_oE\,{}_z\hat g\rhd + {}_z\hat g^*\,{}_oE\,\overgroup{\ddot z\,{}_z\underline{\hat g}}}\rhd$$

$$= \underbrace{\overset{*}{\overgroup{\dot z\,{}_z\underline{\hat g}}}\,{}_oE\,{}_z\hat g}\lhd\!\times\underbrace{\overset{*}{\overgroup{\ddot z\,{}_z\underline{\hat g}}}\,{}_oE\,{}_z\hat g}\rhd + \underbrace{\overset{*}{\overgroup{\dot z\,{}_z\underline{\hat g}}}\,{}_oE\,{}_z\hat g}\lhd\!\times\underbrace{{}_z\hat g^*\,{}_oE\,\overgroup{\ddot z\,{}_z\underline{\hat g}}}\rhd$$

$$+\underbrace{{}_z\hat g^*\,{}_oE\,\overgroup{\dot z\,{}_z\underline{\hat g}}}\lhd\!\times\underbrace{\overset{*}{\overgroup{\ddot z\,{}_z\underline{\hat g}}}\,{}_oE\,{}_z\hat g}\rhd + \underbrace{{}_z\hat g^*\,{}_oE\,\overgroup{\dot z\,{}_z\underline{\hat g}}}\lhd\!\times\underbrace{{}_z\hat g^*\,{}_oE\,\overgroup{\ddot z\,{}_z\underline{\hat g}}}\rhd$$

$$= \underbrace{\overgroup{\ddot z\,{}_z\underline{\hat g}}\,\overset{*}{\overgroup{\dot z\,{}_z\underline{\hat g}}}\,{}_oE\,{}_z\hat g}\lhd\!\times\underbrace{{}_oE\,{}_z\hat g}\rhd + \underbrace{{}_z\hat g\,\overset{*}{\overgroup{\dot z\,{}_z\underline{\hat g}}}\,{}_oE\,{}_z\hat g}\lhd\!\times\underbrace{{}_oE\,\overgroup{\ddot z\,{}_z\underline{\hat g}}}\rhd$$

$$+\underbrace{{}_oE\,\overgroup{\dot z\,{}_z\underline{\hat g}}}\lhd\!\times\underbrace{{}_z\hat g\,\overset{*}{\overgroup{\ddot z\,{}_z\underline{\hat g}}}\,{}_oE\,{}_z\hat g}\rhd + \underbrace{{}_oE\,\overgroup{\dot z\,{}_z\underline{\hat g}}}\lhd\!\times\underbrace{{}_oE\,\overgroup{\ddot z\,{}_z\underline{\hat g}}}\rhd$$

$${}_z\hat g\,\overgroup{\dot z_z\underline{E}}\,\overgroup{\ddot z_z\underline{E}} = \underbrace{{}_oE\,\overgroup{\dot z\,{}_z\underline{\hat g}} - \overgroup{\dot z\,{}_z\underline{\hat g}}\,{}_zE}\,\overgroup{\ddot z_z\underline{E}} = \underbrace{{}_oE\,\overgroup{\dot z\,{}_z\underline{\hat g}} - \overgroup{\dot z\,{}_z\underline{\hat g}}\,{}_zE}\,{}_z\hat g^{-1}\underbrace{{}_oE\,\overgroup{\ddot z\,{}_z\underline{\hat g}} - \overgroup{\ddot z\,{}_z\underline{\hat g}}\,{}_zE}$$

$$= \underbrace{{}_oE\,\overgroup{\dot z\,{}_z\underline{\hat g}} - \overgroup{\dot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,{}_oE\,{}_z\hat g}\,{}_z\hat g^{-1}\underbrace{{}_oE\,\overgroup{\ddot z\,{}_z\underline{\hat g}} - \overgroup{\ddot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,{}_oE\,{}_z\hat g}$$

$$= {}_oE\,\overgroup{\dot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,{}_oE\,\overgroup{\ddot z\,{}_z\underline{\hat g}} - \overgroup{\dot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,{}_oE\,{}_z\hat g\,{}_z\hat g^{-1}\,{}_oE\,\overgroup{\ddot z\,{}_z\underline{\hat g}}$$

$$-\,{}_oE\,\overgroup{\dot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,\overgroup{\ddot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,{}_oE\,{}_z\hat g + \overgroup{\dot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,{}_oE\,{}_z\hat g\,{}_z\hat g^{-1}\,\overgroup{\ddot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,{}_oE\,{}_z\hat g$$

$$= {}_oE\,\overgroup{\dot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,{}_oE\,\overgroup{\ddot z\,{}_z\underline{\hat g}} - \overgroup{\dot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,{}_oE\,\overgroup{\ddot z\,{}_z\underline{\hat g}}$$

$$-\,{}_oE\,\overgroup{\dot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,\overgroup{\ddot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,{}_oE\,{}_z\hat g + \overgroup{\dot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,{}_oE\,\overgroup{\ddot z\,{}_z\underline{\hat g}}\,{}_z\hat g^{-1}\,{}_oE\,{}_z\hat g$$