Flow solver equations:

	$\left\langle egin{array}{c} R_{ ho} \end{array} ight angle$	$R_{ ho ext{u}}$	R_{c_1}	R_{c_2}	R_{c_3}	$\langle R_{c_4} angle$
	$\left(dQ_{ ho} \right)$	$dQ_{ ho E}$	dQ_{c_1}	dQ_{c_2}	dQ_{c_3}	$\langle dQ_{c_4} angle$
$\left. rac{\partial \mathbf{R}_{ ho}}{\partial c_4} ight. $	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial c_4}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial c_4}$	$rac{\partial \mathbf{R}_{ ho_1}}{\partial c_4}$	$rac{\partial \mathbf{R}_{ ho_2}}{\partial c_4}$	$rac{\partial \mathbf{R}_{ ho_3}}{\partial c_4}$	$rac{\partial \mathbf{R}_{ ho_4}}{\partial c_4}$
$rac{\partial \mathbf{R}_{ ho}}{\partial c_3}$	$\frac{\partial \mathbf{R}_{\rho \mathbf{u}}}{\partial c_3}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial c_3}$	$\frac{\partial \mathbf{R}_{\rho_1}}{\partial c_3}$	$\frac{\partial \mathbf{R}_{\rho_2}}{\partial c_3}$	$\frac{\partial \mathbf{R}_{\rho 3}}{\partial c_3}$	$\frac{\partial \mathbf{R}_{\rho_4}}{\partial c_3}$
$\frac{\partial \mathbf{R}_{ ho}}{\partial c_2}$	$\frac{\partial \mathbf{R}_{\rho \mathbf{u}}}{\partial c_2}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial c_2}$	$\frac{\partial \mathbf{R}_{\rho_1}}{\partial c_2}$	$\frac{\partial \mathbf{R}_{\rho_2}}{\partial c_2}$	$\frac{\partial \mathbf{R}_{\rho_3}}{\partial c_2}$	$\frac{\partial \mathbf{R}_{\rho_{\underline{4}}}}{\partial c_2}$
$\frac{\partial \mathbf{R}_{\rho}}{\partial c_1}$	$\frac{\partial \mathbf{R}_{\rho \mathbf{u}}}{\partial c_1}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial c_1}$	$\frac{\partial \mathbf{R}_{\rho_1}}{\partial c_1}$	$\frac{\partial \mathbf{R}_{\rho_2}}{\partial c_1}$	$\frac{\partial \mathbf{R}_{\rho_3}}{\partial c_1}$	$\frac{\partial \mathbf{R}_{\rho_{4}}}{\partial c_{1}}$
$rac{\partial \mathbf{R}_{ ho}}{\partial ho E}$	$\frac{\partial \mathbf{R}_{\rho \mathbf{u}}}{\partial \rho E}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial ho E}$	$rac{\partial \mathbf{R}_{ ho_1}}{\partial ho E}$	$rac{\partial \mathbf{R}_{ ho_2}}{\partial ho E}$	$rac{\partial \mathbf{R}_{ ho 3}}{\partial ho E}$	$rac{\partial \mathbf{R}_{ ho_4}}{\partial ho E}$
$rac{\partial \mathbf{R}_{ ho}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho_1}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho_2}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho_3}}{\partial ho \mathbf{u}}$	$\frac{\partial \mathbf{R}_{\rho_{\underline{4}}}}{\partial \rho \mathbf{u}}$
$\int rac{\partial \mathbf{R}_{ ho}}{\partial ho}$	$\frac{\partial \mathbf{R}_{\rho\mathbf{u}}}{\partial\rho}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial ho}$	$rac{\partial \mathbf{R}_{ ho_1}}{\partial ho}$	$rac{\partial \mathbf{R}_{ ho_2}}{\partial ho}$	$\frac{\partial \mathbf{R}_{\rho 3}}{\partial \rho}$	$\frac{\partial \mathbf{R}_{\rho 4}}{\partial \rho}$

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	/ 9f /	$\frac{\partial f}{\partial \rho}$	$\frac{\partial f}{\partial ho E}$	$\frac{\partial f}{\partial c_1}$	$\frac{\partial f}{\partial c_2}$	$\frac{\partial f}{\partial c_3}$ $\frac{\partial f}{\partial f}$	$\left\langle \frac{\partial \dot{\zeta}}{\partial c_4} \right\rangle$
		$\bigwedge_{\Lambda} \bigvee_{\rho}$	$\Lambda_{ ho E}$	Λ_{c_1}	Λ_{c_2}	$egin{pmatrix} \Lambda_{C_3} \ & \ & \ & \ & \ & \ & \ & \ & \ & \ $	
	$\left. rac{\partial \mathbf{R}_{ ho 4}'}{\partial ho} ight $	$rac{\partial \mathbf{R}'_{ ho_4}}{\partial ho_{\mathbf{u}}}$	$rac{\partial \mathbf{R}_{ ho_4}'}{\partial ho E}$	$rac{\partial \mathbf{R}_{ ho 4}^{\prime}}{\partial c_{1}}$	$rac{\partial \mathbf{R}_{ ho_4}'}{\partial c_2}$	$rac{\partial \mathbf{R}_{ ho_4}'}{\partial c_3}$	$\left. rac{\partial \mathbf{R}_{ ho 4}'}{\partial c_4} ight $
••	$\frac{\partial \mathbf{R}_{\rho 3}^{\prime}}{\partial \rho}$	$rac{\partial \mathbf{R}_{ ho_3}'}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho_3}'}{\partial ho E}$	$\frac{\partial \mathbf{R}_{\rho_3}'}{\partial c_1}$	$\frac{\partial \mathbf{R}_{\rho_3}'}{\partial c_2}$	$rac{\partial \mathbf{R}_{ ho_3}'}{\partial c_3}$	$\frac{\partial \mathbf{R}_{\rho_3}'}{\partial c_4}$
equations:	$\frac{\partial \mathbf{R}_{\rho_2}'}{\partial \rho}$	$rac{\partial \mathbf{R}_{ ho_2}'}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho_2}'}{\partial ho E}$	$\frac{\partial \mathbf{R}_{\rho_2}'}{\partial c_1}$	$\frac{\partial \mathbf{R}_{\rho_2}'}{\partial c_2}$	$\frac{\partial \mathbf{R}_{\rho_2}'}{\partial c_3}$	$\frac{\partial \mathbf{R}_{\rho_2}'}{\partial c_4}$
edna	$\frac{\partial \mathbf{R}_{\rho_1}'}{\partial \rho}$	$rac{\partial \mathbf{R}_{ ho_1}'}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho_1}'}{\partial ho E}$	$\frac{\partial \mathbf{R}_{\rho_1}'}{\partial c_1}$	$\frac{\partial \mathbf{R}_{\rho_1}'}{\partial c_2}$	$\frac{\partial \mathbf{R}_{\rho_1}'}{\partial c_3}$	$\frac{\partial \mathbf{R}_{\rho_1}'}{\partial c_4}$
lver	$rac{\partial \mathbf{R}_{ ho E}}{\partial ho}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial ho E}$	$\frac{\partial \mathbf{R}_{\rho E}}{\partial c_1}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial c_2}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial c_3}$	$\frac{\partial \mathbf{R}_{\rho E}}{\partial c_4}$
djoint solver	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho E}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial c_1}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial c_2}$	$rac{\partial \mathbf{R}_{ ho\mathbf{u}}}{\partial c_3}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial c_4}$
djon	$\sqrt{\frac{\partial \mathbf{R}_{\rho}}{\partial \rho}}$	$rac{\partial \mathbf{R}_{ ho}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho}}{\partial ho E}$	$rac{\partial \mathbf{R}_{ ho}}{\partial c_1}$	$rac{\partial \mathbf{R}_{ ho}}{\partial c_2}$	$rac{\partial \mathbf{R}_{ ho}}{\partial c_3}$	$\sqrt{rac{\partial \mathbf{R}_{ ho}}{\partial c_4}}$

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Adjoint solver equations (before contraction):

$\left\langle \frac{\partial f}{\partial \rho_1} \right\rangle$	$\frac{\partial f}{\partial \rho_2}$	$\frac{\partial f}{\partial \rho_3}$	$rac{\partial f}{\partial ho_4}$	$\frac{\partial f}{\partial ho \mathbf{n}}$	$\frac{\partial f}{\partial \rho E}$
			11		
$\Lambda_{ ho_1}$	$\Lambda_{ ho_2}$	$\Lambda_{ ho_3}$	$\Lambda_{ ho_4}$	$\Lambda_{ ho {f u}}$	$\Lambda_{ ho E}$
$\left. rac{\partial \mathbf{R}_{ ho E}}{\partial ho_1} ight angle$	$rac{\partial \mathbf{R}_{ ho E}}{\partial ho_2}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial ho_3}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial ho_4}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial ho E}$
$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho_1}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho_2}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho_3}$	$\frac{\partial \mathbf{R}_{\rho\mathbf{u}}}{\partial \rho_4}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho E}$
$\frac{\partial \mathbf{R}_{\rho 4}}{\partial \rho_1}$	$\frac{\partial \mathbf{R}_{\rho_4}}{\partial \rho_2}$	$\frac{\partial \mathbf{R}_{\rho_4}}{\partial \rho_3}$	$\frac{\partial \mathbf{R}_{\rho_4}}{\partial \rho_4}$	$rac{\partial \mathbf{R}_{ ho_4}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho_4}}{\partial ho E}$
$rac{\partial \mathbf{R}_{ ho_3}}{\partial ho_1}$	$\frac{\partial \mathbf{R}_{\rho_3}}{\partial \rho_2}$	$\frac{\partial \mathbf{R}_{\rho_3}}{\partial \rho_3}$	$\frac{\partial \mathbf{R}_{\rho_3}}{\partial \rho_4}$	$rac{\partial \mathbf{R}_{ ho_3}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho_3}}{\partial ho E}$
$rac{\partial \mathbf{R}_{ ho_2}}{\partial ho_1}$	$\frac{\partial \mathbf{R}_{\rho_2}}{\partial \rho_2}$	$\frac{\partial \mathbf{R}_{\rho_2}}{\partial \rho_3}$	$\frac{\partial \mathbf{R}_{\rho_2}}{\partial \rho_4}$	$rac{\partial \mathbf{R}_{ ho_2}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho_2}}{\partial ho E}$
$\left(\frac{\partial \mathbf{R}_{\rho_1}}{\partial \rho_1}\right.$	$\frac{\partial \mathbf{R}_{\rho_1}}{\partial \rho_2}$	$\frac{\partial \mathbf{R}_{\rho_1}}{\partial \rho_3}$	$\frac{\partial \mathbf{R}_{\rho_1}}{\partial \rho_4}$	$rac{\partial \mathbf{R}_{ ho_1}}{\partial ho \mathbf{u}}$	$\left rac{\partial \mathbf{R}_{ ho_1}}{\partial ho E} ight $

Flow solver equations (before contraction):

$\left< R_{ ho_1} ight>$	$R_{ ho_2}$	$R_{ ho_3}$	$R_{ ho_4}$	$R_{ ho ext{u}}$	$\begin{pmatrix} I \iota \rho E \end{pmatrix}$
		ļ			
$/dQ_{ ho_1} \Big angle$	dQ_{ρ_2}	dQ_{ρ_3}	dQ_{ρ_4}	$dQ_{ m ho u}$	$\langle dQ_{ ho E} angle$
$\overline{\mathbb{E}^{01}}$	- 60 100 100 100 100 100 100 100 100 100 1	E 3	904 E		$\frac{1}{E}$
$rac{\partial \mathbf{R}_{ ho_1}}{\partial ho E}$	$rac{\partial \mathbf{R}_{ ho_2}}{\partial ho E}$	$rac{\partial \mathbf{R}_{ ho 3}}{\partial ho E}$	$\frac{\partial \mathbf{R}_{\rho_4}}{\partial \rho E}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho E}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial ho E}$
$rac{\partial \mathbf{R}_{ ho_1}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho_2}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho_3}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho_4}}{\partial ho_{\mathbf{u}}}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho \mathbf{u}}$	$rac{\partial \mathbf{R}_{ ho E}}{\partial ho \mathbf{u}}$
$rac{\partial \mathbf{R}_{ ho_1}}{\partial ho_4}$	$\frac{\partial \mathbf{R}_{\rho_2}}{\partial \rho_4}$	$\frac{\partial \mathbf{R}_{\rho 3}}{\partial \rho_4}$	$\frac{\partial \mathbf{R}_{\rho_4}}{\partial \rho_4}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho_4}$	$\frac{\partial \mathbf{R}_{\rho E}}{\partial \rho_4}$
$rac{\partial \mathbf{R}_{ ho_1}}{\partial ho_3}$	$\frac{\partial \mathbf{R}_{\rho_2}}{\partial \rho_3}$	$rac{\partial \mathbf{R}_{ ho_3}}{\partial ho_3}$	$\frac{\partial \mathbf{R}_{\rho_4}}{\partial \rho_3}$	$\frac{\partial \mathbf{R}_{\rho \mathbf{u}}}{\partial \rho_3}$	$\frac{\partial \mathbf{R}_{\rho E}}{\partial \rho_3}$
$rac{\partial \mathbf{R}_{ ho_1}}{\partial ho_2}$	$\frac{\partial \mathbf{R}_{\rho_2}}{\partial \rho_2}$	$rac{\partial \mathbf{R} ho_3}{\partial ho_2}$	$\frac{\partial \mathbf{R}_{\rho_4}}{\partial \rho_2}$	$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho_2}$	$\frac{\partial \mathbf{R}_{\rho E}}{\partial \rho_2}$
				$rac{\partial \mathbf{R}_{ ho \mathbf{u}}}{\partial ho_1}$	