Equations integrated in PyTelTools

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1 Variables notations

Notation of 2D and 3D variables are described on this wiki page : https://github.com/CNR-Engineering/PyTelTools/wiki/Notations-of-variables. Variable notations used in this document are based on the `varID` column of the tables presented on latter webpage.

2 Constants

Equations may contain following constants:

Notation	Description	Value and unit
g	gravitational accelaration on earth	9.80665 $m.s^{-2}$
ρ	water density	1000 $kg.m^{-3}$
κ	Von Kármán constant	0.4

These constants are set in `slf/variable/variables_utils.py`.

3 Equations in 2D

3.1 Hydraulic variables

$$\mathrm{H} = \mathrm{S} - \mathrm{B}$$
$$\mathrm{S} = \mathrm{H} + \mathrm{B}$$
$$\mathrm{B} = \mathrm{S} - \mathrm{H}$$
$$\mathrm{M} = \sqrt{\mathrm{U}^2 + \mathrm{V}^2}$$
$$\mathrm{I} = \mathrm{H} \times \mathrm{U}$$
$$\mathrm{J} = \mathrm{H} \times \mathrm{V}$$
$$\mathrm{Q} = \sqrt{\mathrm{I}^2 + \mathrm{J}^2}$$
$$\mathrm{C} = \sqrt{g\,\mathrm{H}}$$
$$\mathrm{F} = \frac{\mathrm{M}}{\mathrm{C}}$$

3.2 Sediment transport variables

$$\mathrm{HD} = \mathrm{B} - \mathrm{RB}$$
$$\mathrm{B} = \mathrm{HD} - \mathrm{RB}$$
$$\mathrm{RB} = \mathrm{B} - \mathrm{HD}$$
$$\mathrm{QS} = \sqrt{\mathrm{QSX}^2 + \mathrm{QSY}^2}$$
$$\mathrm{QS} = \mathrm{EF} + \mathrm{DF}$$
$$\mathrm{QSBL} = \sqrt{\mathrm{QSBLX}^2 + \mathrm{QSBLY}^2}$$
$$\mathrm{QSSUSP} = \sqrt{\mathrm{QSSUSPX}^2 + \mathrm{QSSUSPY}^2}$$
$$\mathrm{QSX} = \mathrm{QS}\frac{\mathrm{U}}{\mathrm{M}} \text{ if } \mathrm{M} > 0 \text{ else } 0$$
$$\mathrm{QSY} = \mathrm{QS}\frac{\mathrm{V}}{\mathrm{M}} \text{ if } \mathrm{M} > 0 \text{ else } 0$$
$$\mathrm{QSBLX} = \mathrm{QSBL}\frac{\mathrm{U}}{\mathrm{M}} \text{ if } \mathrm{M} > 0 \text{ else } 0$$
$$\mathrm{QSBLY} = \mathrm{QSBL}\frac{\mathrm{V}}{\mathrm{M}} \text{ if } \mathrm{M} > 0 \text{ else } 0$$
$$\mathrm{QSSUSPX} = \mathrm{QSSUSP}\frac{\mathrm{U}}{\mathrm{M}} \text{ if } \mathrm{M} > 0 \text{ else } 0$$
$$\mathrm{QSSUSPY} = \mathrm{QSSUSP}\frac{\mathrm{V}}{\mathrm{M}} \text{ if } \mathrm{M} > 0 \text{ else } 0$$

3.3 Friction velocity

$$\mathrm{US} = \sqrt{\frac{1}{2} C_f \, \mathrm{M}^2}$$

Law	Coefficient
Chézy	C
Strickler	K
Manning	m
Nikuradse	k_S

3.3.1 Chézy

$$C_f = \frac{2g}{C^2}$$

3.3.2 Strickler

$$C_f = \frac{2g}{K^2 \mathrm{H}^{1/3}}$$

3.3.3 Manning

$$C_f = \frac{2gm^2}{\mathrm{H}^{1/3}}$$

3.3.4 Nikuradse

$$C_f = \frac{2\kappa^2}{\left[\log\left(\frac{30}{e^1}\frac{\mathrm{H}}{k_S}\right)\right]^2}$$

3.4 Bed shear stress, Rouse number and diameter

$$\mathrm{TAU} = \tau = \rho \, \mathrm{US}^2$$

$$R_0 = \frac{w_s}{\kappa \, \mathrm{US}}$$

$$\mathrm{FROTP} = \mathrm{MU} \ \mathrm{DMAX}$$

$$\mathrm{DMAX} = \begin{cases} 1.4593 \times \tau^{0.979} & \text{if } \tau > 3.4 \\ 1.2912 \times \tau^2 + 1.3572\tau - 0.1154 & \text{if } 0.1 < \tau \leqslant 0.34 \\ 0.9055 \times \tau^{1.3178} & \text{if } \tau \leqslant 0.1 \end{cases}$$

4 Equations in 3D

$$\mathrm{M} = \sqrt{\mathrm{U}^2 + \mathrm{V}^2 + \mathrm{W}^2}$$

$$\mathrm{NU} = \sqrt{\mathrm{NUX}^2 + \mathrm{NUY}^2 + \mathrm{NUZ}^2}$$