FLUID MECHANICS
TESTS

Attention: there might be more correct answers to the questions.

Chapter 7: Momentum equation and its applications

T.7.1.1 The following form of the momentum equation is given:

$\int_A \underline{v}\,\rho(\underline{v}d\underline{A}) = -\int_A p d\underline{A} + \int_V \rho \underline{g} dV$. Which statement is true?

a, the elementary pressure force is anti-parallel (parallel, but having opposite sign) with the surface normal,

b, the external force field needs to be potential

c, on the left side of the equation, the direction of the elementary vector after the integral is always parallel with the surface normal direction

d, the equation is valid for unsteady flows as well.

The answer is:

T.7.1.2 The following equation $\int_A \underline{v}\,\rho(\underline{v}d\underline{A}) = -\int_A p d\underline{A} + \int_V \rho \underline{g} dV$ is limited in use:

a, you can only use it for irrotational flows,

b, it neglects the force from friction,

c, you can only use it for steady flows,

d, the external field of force needs to be potential,

e, solids are forbidden inside the control surface

The answer is:

T.7.1.3 *What happens when a flat surface is put perpendicularly into a water jet?*

a, the water losses all of its velocity,

b, the jet cross-section leaving the surface equals to the jet cross section upstream of the surface,

c, the velocity of the water is reduced by the time it reaches the exit

d, the pressure on the flat surface is lower, than the external pressure.

The answer is:

T.7.2.1 For a sudden cross-section growth the pressure loss ($\Delta p'_{BC}$) is:

a, $\frac{\rho}{2}\cdot(v_1^2 - v_2^2)$

b, $\frac{\rho}{2}\cdot(v_1 - v_2)$

c, $\rho\cdot(v_1^2 - v_2^2)$

d, $\rho\cdot(v_1 - v_2)^2$

e, $\frac{\rho}{2}\cdot(v_1 - v_2)^2$

The answer is:

T.7.3.1 Kutta-Joukowsky theorem

a, makes a connection between the circulation around the wing and the lift force,

b, has the form of $R = \rho \cdot g \cdot \Gamma$

c, has the form of $F_f = \rho \cdot |\underline{v_\infty}| \cdot \Gamma$

d, gives information about drag as well

The answer is:

T.7.4.1 A boat is moving with a velocity of 10 m/s, as compared to the water. The velocity of the water behind the propeller is 20 m/s, as compared to the propeller. How much is the propulsive efficiency?

a, 50%,

b, 67%,

c, there is not enough information,

d, 200%,

e, all of the answers are incorrect.

The answer is:

T.7.4.2 Studying the propeller force, the following equations can be deduced:

a, $q_m = \rho \cdot A \cdot v_e$,

b, $v = \frac{v_e + v_u}{2}$,

c, $R = \rho \cdot A \cdot (v_u^2 - v_e^2)$

d, $R = q_m(v_u - v_e)$

e, *the other answers are incorrect.*

The answer is: