Belmopan thermal energy storage

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The forced convective flow of a nanoliquid and particles of a nanoencapsulation PCM (NePCM) is studied in trapezoidal-shaped cavities with a wavy bottom wall. Figure 1 depicts the structural configuration of the enclosure under investigation, featuring a top wall that is driven by a lid.

Besides the assumptions mentioned earlier, the three-dimensional flow is steady and laminar, and the suspension is incompressible. The gravity effect is in the normal direction, and both the forced and free convection modes are assumed. The suspension has the components water and NePCM. Also, the well-known Boussinesq relation is applied for the mixture density. The following equations describe continuity, momentum, and energy40,41:

Where (:x,y,z:)are Cartesian coordinates, and the dimensional quantities are velocities (:u),(:v,w), temperature (:T), pressure(::p), thermal expansion (:beta:), density, gravity(:g), and the dynamic viscosity(::mu:). The subscript b states the suspension bulk characteristics.

Where (:X,Y,Z) are the dimensionless coordinates, (:U,V,:W) are the dimensionless velocity, and (:theta:) is the dimensionless temperature. The non-dimensional numbers associated with the problem read40:

The local entropy generation pace consists of the thermal and frictional entropy generation rates, which are represented by Eqs. (8) and (9), correspondingly45,46:

The nano-encapsulated PCM comprises a nonadecane core that is enveloped by a polyurethane shell. Table 1 shows the thermophysical factors of the constituents utilized in the production of the nano-additives and the basic liquid.

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