

## English summary

Rakenteiden Mekaniikka (Journal of Structural Mechanics)  
Vol. 42, No 4, 2009, pp. 200-207

### On the rigid body model in thermodynamics

Martti Mikkola and Eero-Matti Salonen

**Summary.** A very simple application of the first law of thermodynamics considered in textbook [5] is referred to. The application concerns sliding of a block of material on a surface with constant velocity. The final conclusion drawn in the book on this application is criticized. The confusing result obtained in the book is explained in the article based on the unrealistic behavior of the rigid body model in this application concerning friction. In reality in the contact of apparently smooth surfaces small relative movements of surface irregularities take place. Taking into account the work done in these surface irregularities removes qualitatively the problem expressed in the book. An alternative, more quantitatively explanation is also presented.

*Key words:* thermodynamics, first law, sliding of a rigid body

Rakenteiden Mekaniikka (Journal of Structural Mechanics)  
Vol. 42, No 4, 2009, pp. 218-234

### Hydrogen in energy production

Pauli Jumppanen

**Summary.** The paper discusses different technological and economic aspects of the use of hydrogen as a fuel for the energy production. Currently, 95 % of hydrogen is produced by means of steam reforming and conventional electrolysis. For future, however, coal gasification and nuclear energy with steam electrolysis offer the largest production potential. High pressure tanks and liquefied hydrogen are traditionally used for storage and transport applications within the hydrogen energy production value chain. Metal and chemical hydrides, carbon nanostructures and a number of other materials may also be used to store and transport smaller volumes of hydrogen e.g. to operate light duty vehicle, small generators and portable electronic devices. Fuel cells convert hydrogen into power and heat in a chemical process with efficiencies up to 60 % electric and 90% in co-generation, and if the hydrogen is produced from renewable sources, no significant emissions will arise. These facts have given birth to an energy-political concept commonly known as “the hydrogen economy”, which should be implemented as a main tool for the reduction of global carbon dioxide emissions. Realization of the hydrogen economy would require large scale hydrogen production, major improvements in the storage and transport technologies, and massive investment in the construction of a new energy infrastructure. The Author concludes that the global hydrogen economy would not be feasible before the second part of the century, at the earliest. Nevertheless, need for hydrogen technology development is increasing together with new business opportunities for the energy industry.

*Key words:* hydrogen energy, hydrogen economy, coal, hydrocarbon, fuel cell, biomass, renewable energy, carbon dioxide emission

## **Direct insolation**

Matti A Ranta and Laila Hosia

**Summary.** While exploiting solar energy one must know the solar radiation arriving at the top of the Earth's atmosphere, the so-called solar constant. The latitude of the place where the solar energy is going to be exploited must be known in addition to the season and the time of a day as well as the local meteorological conditions.

*Key words:* solar constant, solar declination, local latitude, solar elevation angle, damping constant of air or opacity