# TU Delft
# Highlights

## 2011

## Bill Rossen, professor, lecturer of the year:

# 'I challenge my students to challenge me'

Bill Rossen has a Bachelor's degree in Chemical Engineering from MIT, and a PhD degree, also in Chemical Engineering, from the University of Minnesota. He worked at the University of Texas at Austen, and as a researcher with Chevron. Since 2006 he is professor of Reservoir Engineering and head of the Petroleum Engineering section in the Department of Geoscience and Engineering. In November 2011 he was voted best lecturer of the year.

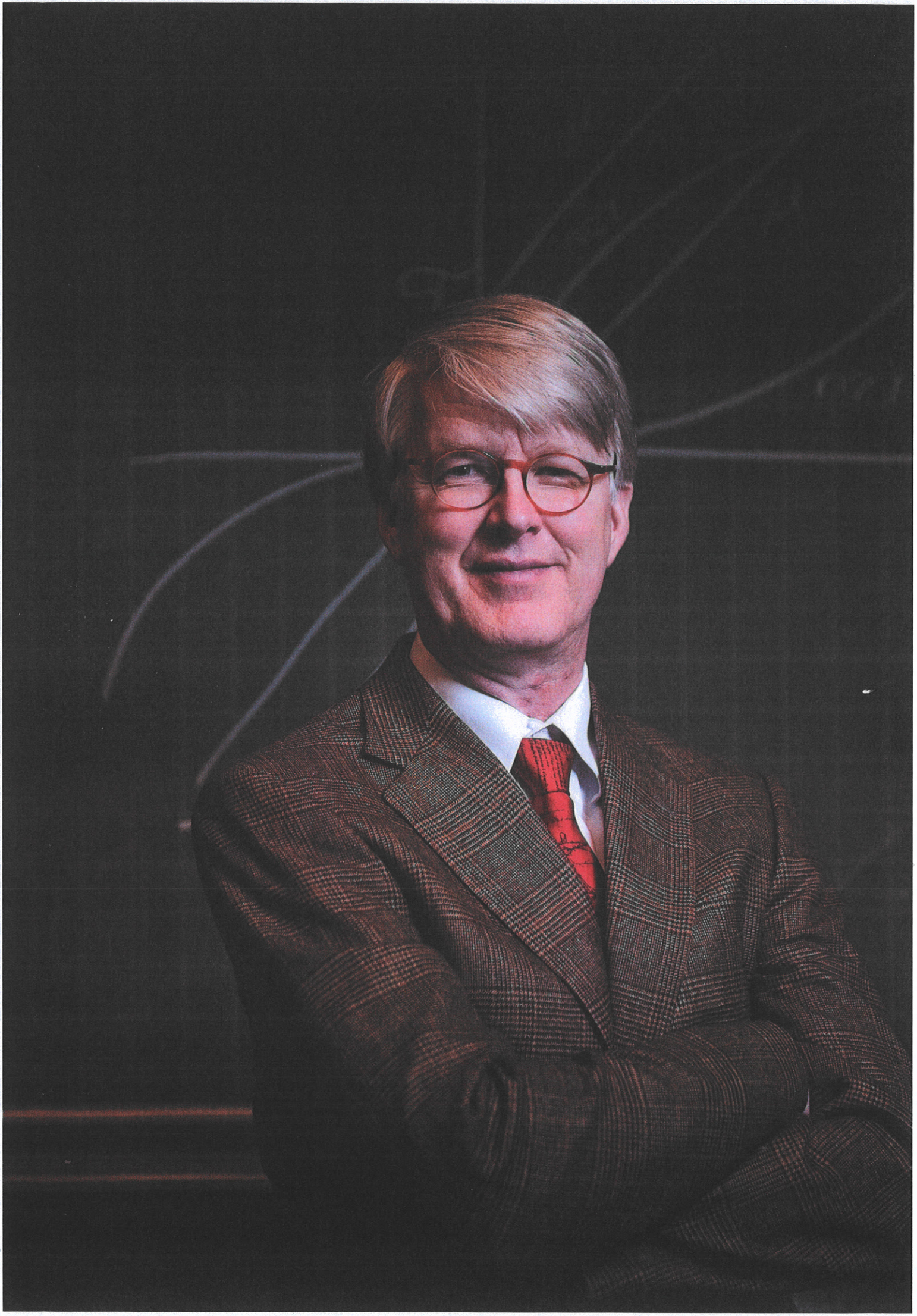
Bill Rossen enjoys living in The Netherlands and being able to cycle to work. He has been married for over 35 years to Janice with whom he shares a love of dogs and the city of Delft. And for reading aloud with friends, something they have enjoyed since their days in Texas: "Every Sunday afternoon we would read a Shakespeare play out loud. Over the course of a year we would get through the entire corpus."

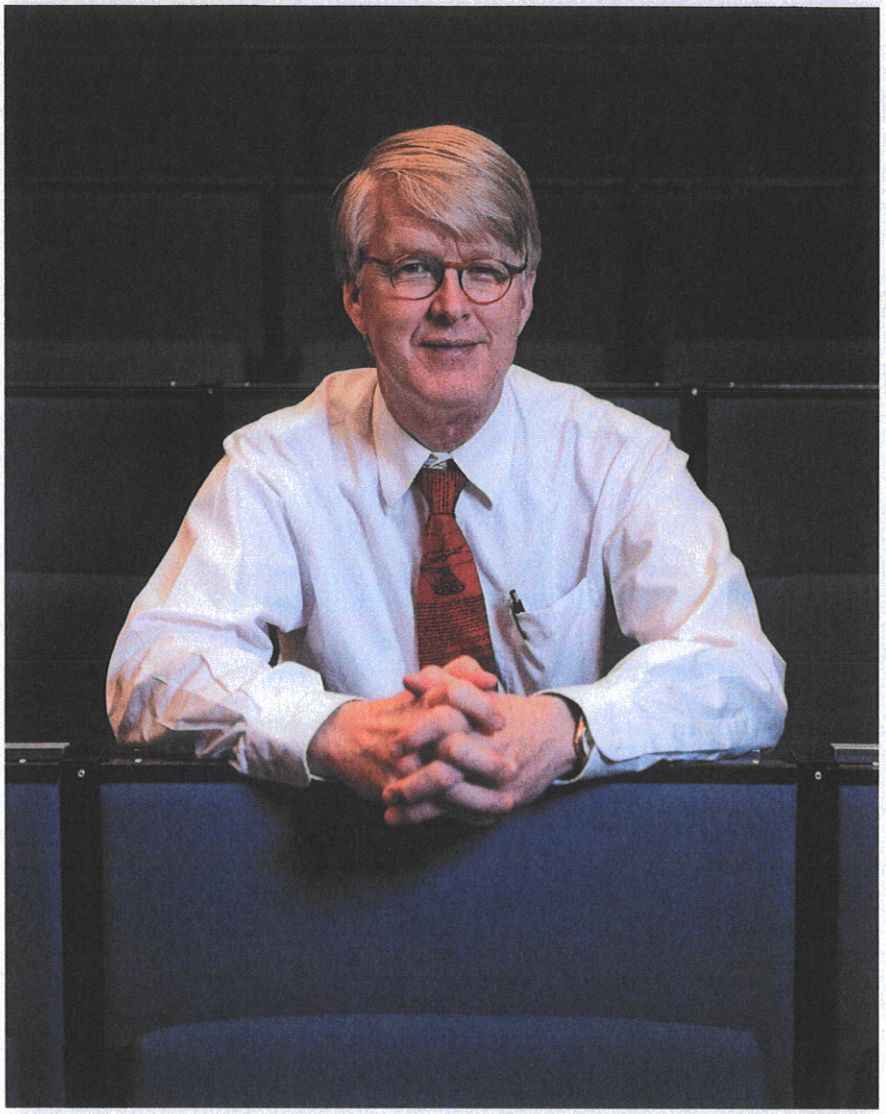
### Who was your inspiration to become a teacher?

I had a few of them. One of them was Neal Amundson, a professor at the University of Minnesota. He was an exquisitely precise teacher. He made extremely clear what you definitely needed to know, and what was provided as background. I admired that very much. Another inspiration was Ted Davis, my PhD advisor at Minnesota, who taught some classes during my first year in graduate school. I became so enthusiastic that I wanted to do whatever he was doing, and I became his research student. And then there was Robert Reid, a chemical engineering professor at MIT. He was an excellent teacher who wrote a textbook on thermodynamics. The homework problems featured a character called Rocky Jones, who had these hare-brained ideas, e.g. for perpetual motion machines, that you had to analyse. I often deploy some character in my homework or exam problems too. It is a good conceit, because what your character says does not necessarily have to be true. You simply say 'he assumes'. A favourite problem I use to teach heat transfer is that of a murder case where a doctor estimates the time of death of a body that was found at the bottom of a lake.

### Is there a recipe for good teaching?

I believe that all good teaching has a few things in common. You should be seen to





be enthusiastic about your subject and excited about teaching it. You also have to be genuinely interested in students and let them know you are. During class you should pay attention so that you notice when they are staring blankly at you. I always try to listen to myself. I teach in English, a foreign language for most of my bachelor students. And when I really get into a subject, I talk very fast, so I may have to go back and repeat a few things if the class is still furiously writing. Or sometimes I realize what I am not communicating. Years ago, I taught a course on probability. One of my best students concluded that you should bet on the numbers that hadn't come up yet in the Texas state lottery. He had clearly missed something fundamental about randomness, so I then changed my lectures accordingly.

## How does your research feature in your lectures?

I often use my research as illustration when I teach. I also like to tie-in class work with research experiments. For example, once we had trouble keeping our flow apparatus at the right temperature during some experiments. This led to a couple of exam problems in which I let the students figure out why it was so difficult to maintain temperature effectively. In one of these, they had to work out the minimum amount of insulation that was needed around a piece of tube. They were solving the actual problem at that point, though they probably did not realize it at the time. In most cases, you want a precise answer in your research and for that you use a sophisticated computer programme. But you can get quick, rough answers with the tools we teach in our third-year bachelor programme. I love that kind of thing.

## Do you get something back from your students?

Oh yes. Teaching is a chance to get in front of people and talk about something I really like. And when it works, it's practically magic. Those moments when you make the seemingly inscrutable and inexplicable clear to people, and they all get it and go 'ah'. And as part of my 'fluid flow heat & mass transfer' course I let students come up with their own homework problems. I challenge them to challenge me. They can be very creative. Last year, a student was inspired by the peanut butter floor that was exhibited in Museum Boijmans Van Beuningen in Rotterdam. At what angle would the peanut butter slide off if the floor is tilted, was his question. Another

### Personal highlights

In addition to the teaching award, his personal highlights of 2011 were being named an 'IOR Pioneer' in his field of research (Improved Oil Recovery, or IOR) by the Society of Petroleum Engineers.

*'An international company studied their employees and the ones from TU Delft perform near the top'*

student once came up with a problem about the fluid mechanics of water flowing into the Titanic through a slit in the hull. That one is now a standard homework assignment. This year a student analysed the flow profile of a glacier sliding down a mountain valley, in connection with the story of Scrooge McDuck (Oom Dagobert in the Dutch version of Donald Duck, I think) losing his dogsled full of gold into a crack in a glacier, and coming back to find it melting out of the end of the glacier 40 years later.

### What are you going to do with the prize money you were awarded as best lecturer?

In a sense we are getting our best teacher from 2009 back. Two years ago Susanne Rudolph, also from the Petroleum Engineering section, was voted TU Delft's best lecturer. She has since left Delft because her husband got an outstanding job offer in Berlin. We are going to video her lectures on thermodynamics and post them on the web. This is a subject we expect students to have done before starting their master's programme, but that is not always the case, because they come from different bachelors. So some people have to follow the thermodynamics course simultaneously with courses that expect them to have mastered the subject already. In future they can be well-prepared ahead of time.

### Do you think there is something special about a TU Delft education?

Employers often compliment us on our students, so we seem to be doing it right. At least one employer, and international company, studied their employees and the ones from TU Delft perform near the top. Then they come back to us because they like to hire more of our graduates, which is really encouraging. There is a lot of emphasis on self-reliance and independence here; that is one strength of the Delft education. For example, the Delft Geothermal Project (DAP) was initiated by students. Independence can work stupendously. But a fair fraction of students will stumble and fall given that independence.

It is also a difficult balance between what to teach and how much to leave to students to learn afterwards. In our petroleum engineering courses we try to cover the basics and the principles that a student needs to know without being so specific that the knowledge will be out of date in a few years. When new breakthroughs come, they should still fit within that framework. Having taught in two different continents, I would say, we don't give as much detail as in the US but we supply a broader background, especially in the geosciences.

## The science of shaving cream

Bill Rossen is an expert in the field of improved oil recovery (IOR). For 25 years he has studied the mechanisms and modelling of foam for Improved Oil Recovery.
This is where shaving cream comes in, something he uses as a demonstration in class each year. "Shaving cream is a fluid, but it behaves as a solid if you don't stress it very much. That is why it works for shaving, because it stays in place. It is a great example of yield stress: the applied stress you have to exceed to make the liquid flow."

Similar fluids are used in the petroleum industry. "When you are drilling a well you always grind up bits of rock from the bottom", explains Rossen, "With foam you can keep these in suspension for a couple of hours. You can do that with viscous water, but that is a bit of a race. Can you bring it up faster than the particles fall down? And what if your pump breaks? Moreover, they are now doing such fantastic things with the snake drilling of wells: they go up and down at an angle and turn around corners. The distance to the bottom is sometimes only a few centimetres, so you really want to hold on to the drilling grit".