

Course: **Ultrasound contrast agents: Theory and experiment.**

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Abstract:

The course consists of 4 topics:

a) Physics of microbubbles

The basic physics of bubble vibration will be discussed. How does the bubble survive in a liquid. Models of the behavior of small bubbles in an ultrasound field. Simple models based on a one dimensional mass-spring system and more complicated models including gas and shell properties. How can we use these models.

b) Contrast imaging

Imaging methods for contrast agents, e.g. fundamental, harmonic, subharmonic and superharmonic and multi-pulse methods like pulse inversion, power modulation etc. and new methods including chirp excitation and radial modulation.

c) Ultrasound contrast agent characterisation

Experimental acoustic methods for UCA will be presented for characterizing the bubbles in suspension, including harmonic and subharmonic scattering, absorption and attenuation. Also the influence of ambient pressure, temperature and gas concentration will be discussed. Further, optical and acoustical methods for characterizing individual bubbles.

d) Molecular imaging and therapy

Molecular imaging and ultrasound mediated drug delivery: How to make these bubble, what are the characteristic. Also the interaction between mammalian cells and ultrasound in the presence of (targetted) bubbles will be discussed

Nico de Jong graduated from Delft University of Technology, The Netherlands, in 1978. He got his M.Sc. in the field of pattern recognition. Since 1980, he has been a staff member of the Thoraxcenter of the Erasmus University Medical Center, Rotterdam, The Netherlands. At the Dept. of Biomedical Engineering, he developed linear and phased array ultrasonic probes for medical diagnosis, especially compound and transesophageal transducers. In 1986 his interest in ultrasound applications shifted toward the theoretical and practical background of ultrasound contrast agents. In 1993 he received his Ph.D. for "Acoustic properties of ultrasound contrast agents." His current interests are 3D (matrix) transducers, bubble behaviour and fast framing camera systems. Since 1996 he organizes, together with the cardiologist Dr. Folkert ten Cate, the annual European Symposium on Ultrasound Contrast Imaging, held in Rotterdam and attended by approximately 175 scientists from all over the world. Since 2003 Nico de Jong is part-time professor at the University of Twente.

Michel Versluis graduated in Physics in 1988 at the University of Nijmegen, the Netherlands, with a special interest in Molecular Physics and Astrophysics. Later, he specialized in the application of intense tunable UV lasers for flame diagnostics resulting in a successful defense of his PhD thesis in 1992. Michel Versluis is now a lecturer at the University of Twente, the Netherlands, in the Physics of Fluids group working on the experimental study of bubbles and jets in multiphase flows and granular flows. He also works on the use of microbubbles as a tool for medical diagnosis and therapy. Dr. Versluis teaches various courses in Fluid Mechanics, one of them focusing on the physics of bubbles.