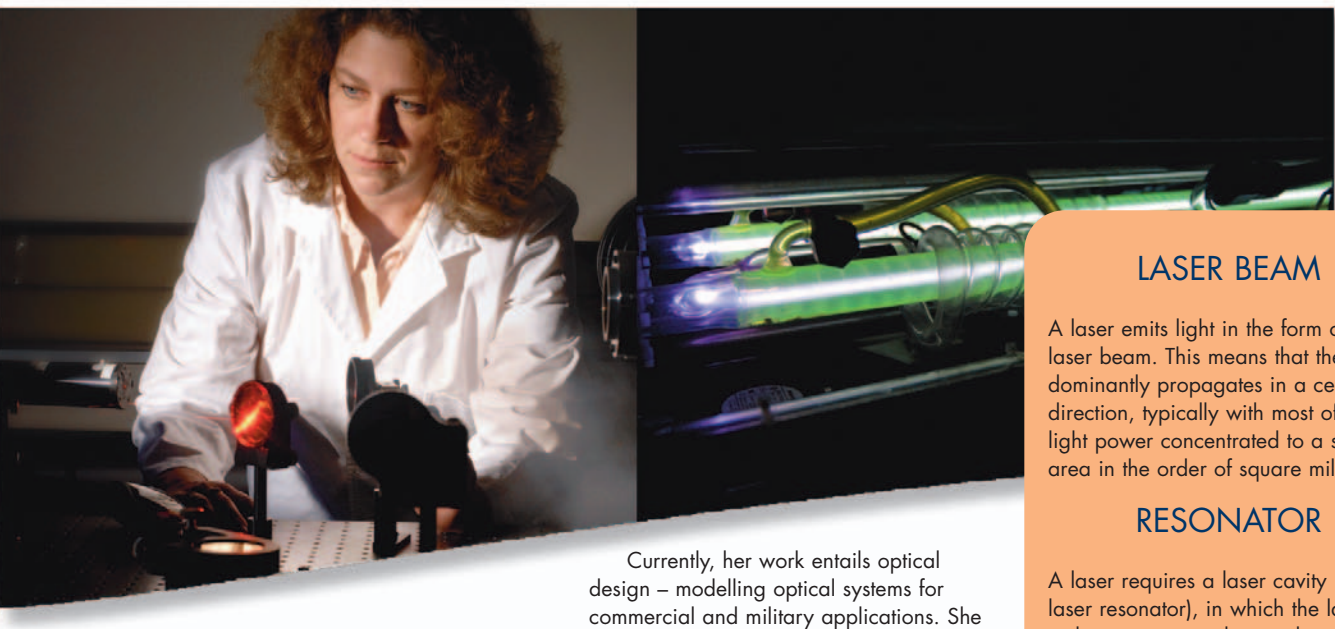
Liesl Burger

Focusing the power of light

Liesl Burger uses the power of lasers daily in advanced research for industrial and military applications. CSIR laser research has also been extended to the use of lasers in the health domain and in combating air pollution.



New research focus for optical engineering

"I'm looking forward to the future with a great deal of optimism," says Liesl, an optical engineer at the CSIR National Laser Centre. Referring to the challenges presented by the CSIR's Beyond 60 process with its renewed focus on research, she says, "I started my career with research into tuneable carbon dioxide lasers after which the focus turned to commercial applications. Now I am quite pleased to once again be channelling my energies into the challenges a research focus presents."

The industrial applications of lasers are typically for cutting machines with which to cut non-metals such as plastics, cardboard and even fabric. In the military field, lasers are useful in missile countermeasures, laser range finders and target designation. Other applications that are being investigated with research partners are how laser technology can improve wound healing in diabetic patients and kill cancerous cells. The CSIR is also looking at the use of Differential Absorption Lidar (DIAL) to assist in combating atmospheric pollution.

The lure of lasers

Liesl fell in love with physics and applied mathematics at school, and it seemed logical for her to pursue a BSc degree at the University of the Witwatersrand. As she was a CSIR bursar, she was afforded the opportunity to work at the organisation during vacations and upon completion of her studies. "I started off working in the laser section of the unit then called Productiontek," Liesl explains. "Lasers interested me and I decided to stay," she adds. The laser section later became the CSIR National Laser Centre (NLC).

Currently, her work entails optical design – modelling optical systems for commercial and military applications. She uses various software packages such as Zemax and GLAD to model the path of light through components such as lenses, laser resonators and reflections off mirrors.

Zemax is a ray-tracing package, which can be used to model any lens system, although the CSIR's focus is predominantly on lenses used in laser applications. Other applications may include the modelling of photographic lenses, scanning systems, numerically-controlled computer (NCC) equipment or any other optical system. The GLAD system, on the other hand, models the wave nature of light, and is more useful for modelling laser systems because it is physically more accurate. "There is an overlap in functionality, but typically I use the one for lenses and the other for laser resonators," Liesl explains. "Our work includes assisting clients in any of the many laser application domains in producing or optimising a laser for their specific application. What we ultimately offer them is detailed information on the beam they can expect, as well as the tool to optimise it."

Liesl says clients specify the characteristics of the laser beam they require, for example, the size of the beam at some point, its energy, pulse length and divergence. A laser with associated optics can be designed to meet these requirements. "Simplified, you 'tell' the software what the initial beam looks like, and what its profile and intensity are. You 'inform' the software what the beam passes through (lenses, apertures, etc.) and propagate the light through these components. The software then models diffraction effects and keeps track of the energy distribution. This software is a really powerful tool," she says, "but the skill lies in developing a model that accurately predicts real-world behaviour."

LASER BEAM

A laser emits light in the form of a laser beam. This means that the light dominantly propagates in a certain direction, typically with most of the light power concentrated to a small area in the order of square millimetres

RESONATOR

A laser requires a laser cavity (or laser resonator), in which the laser radiation can circulate and pass a gain medium that compensates the cavity losses

PHYSICAL OPTICS

The branch of optics that treats light propagation as a wave phenomenon rather than a ray phenomenon, as in geometric optics

Liesl's work requires an understanding of computer programming and physics. She undertakes work mostly for external clients, but also advises her colleagues who are conducting research into an array of laser-related projects. Some of her previous projects included building laser-cutting machines and other laser systems, for example, laser systems used by architects to almost effortlessly construct a model from a CAD drawing.

On a personal note

Professional achievements are not about prestigious awards for her, but rather about experimentally verifying the systems that she has modelled. At the top of her personal achievements list is raising two bright children. She reads many popular science publications and says that author Carl Sagan inspires her. Her high school maths and science teachers were her role models while growing up. Liesl describes herself as being an "inquisitive, rational and methodical person who listens to a lot of alternative rock music." She recently attended a rock concert in London, and collects bootleg recordings. She cites hard work and believing in oneself as important traits, and it is these attributes that she encourages young women out there to aspire to.

– Tlhogi Mokhema