Green lasers, emitting light with a wavelength above 500 nanometers, are gaining popularity in various fields of science and technology. Their unique properties make them extremely versatile and effective in many applications, from medicine to industry and entertainment. They are used in ophthalmic surgery, where precise cutting and coagulation are essential. They are also employed in dermatology for tattoo removal and vascular lesion treatment. In industry, green lasers are used for precise cutting and marking of materials. Thanks to their high precision, they are ideal for metal processing. Green laser pointers are commonly used during presentations because green light is the most visible to the human eye, making them more visually effective than red or blue lasers of the same power. Unfortunately, most of these applications either require large lasers or the conversion of infrared radiation emitted by semiconductor lasers to green light. Both solutions are inefficient and uneconomical, which significantly limits the use of green lasers in these fields. Therefore, it is necessary to develop appropriate semiconductor lasers that directly generate green light with high efficiency and attractive operating parameters, especially with high optical power. Developing small compact arrays of these lasers would achieve the mentioned goals and contribute to finding many other interesting applications for these sources. Currently, there are no available arrays of semiconductor lasers emitting green light. The best candidates for constructing green laser arrays are edge-emitting semiconductor lasers. Compared to other popular semiconductor lasers, such as VCSELs (Vertical Cavity Surface Emitting Lasers), they have higher output power, which is particularly important in applications requiring an intense light source. The design of edge-emitting lasers also allows for greater flexibility in designing laser parameters, such as emission wavelength and output power. This enables their adaptation to a wide range of applications, from telecommunications to medicine. As modern technology strives for miniaturization, further technological development necessitates the design of compact edge-emitting laser arrays that could be used in small (micro or pico scale) portable projectors, semiconductor lighting, medical equipment, and emergency lighting, because green light beams show weak dependence on external conditions.

Unfortunately, achieving compact arrays emitting green light involves solving problems such as inefficient optical field confinement in the laser and reducing excessively high temperatures and equalizing the temperature in each array emitter. These phenomena adversely affect the operating parameters of the array and its performance. I will attempt to solve these mentioned problems based on computer simulations. With their help, appropriate solutions will be developed to improve or even enable the operation of one-dimensional arrays of edge-emitting semiconductor lasers made in nitride technology and designed for green light emission. The solutions proposed in the research should be particularly helpful for the industry and consequently lead to the creation of laser arrays and enable their commercialization.