The doctoral dissertation presents investigations into novel quasi-resonant boost converters with a tapped inductor.

Chapter 1 introduces a reader to the problem of boosting voltage by a DC / DC converter. The chapter begins with the comparison of conduction losses in three different DC/DC converters: basic, isolated flyback and flyback with the tapped inductor. A conductivity losses analysis showed that the converter with the tapped inductor is characterized by the best properties of the boost voltage and allows the use of a smaller size magnetic component. Next, the chapter shows various configurations of a resonant switch; the principle of their operation is discussed on the basic quasi-resonant boost converter. In the further part of the chapter, an overview of boost converters with tapped inductors described in scientific literature is presented. Lastly, the chapter discusses selected areas of application of the boost converters.

The next chapters present the novel quasi-resonant boost converters with the tapped inductor developed by the author of the dissertation. The most important characteristics: control, and voltage ratings of power semiconductors are described and procedures of resonant circuits design are given.

Chapter 2 presents two boost quasi-resonant converters with the tapped inductor and transistors switched at zero current. The first converter was controlled with constant turn-on time of the switch, which depended on resonant frequency; a voltage gain coefficient was changed by turn-off time. In this circuit, switching losses were almost completely eliminated, but due to additional resonance currents, the conduction losses increased. In the second converter, a transistor was added in series with the resonant capacitor. The transistor was switched on for turn-off time of the main transistor. It reduced the values of the resonant current and increased energy conversion efficiency. The chapter also presents a laboratory model which was built and tested. The converter achieved high efficiency (94.8%) at maximum output power of 1.2 kW and voltage gain of 7.6.

Chapter 3 presents two quasi-resonant boost converters with the tapped inductor and transistors switched at zero voltage. Similarly, to Chapter 2, a converter with one switch controlled with variable frequency and with two switches controlled with pulse width modulation (PWM) is presented. The laboratory model is presented and experimental results are discussed. The converter achieved high efficiency (93.5%) at maximum output power of 300 W and voltage gain of 7.6.

The last chapter presents a switched capacitor boost converter with the tapped inductor and a quasi-resonant passive snubber. This converter uses an additional circuit with two capacitors and two diodes to achieve higher voltage gain and zero voltage turn-on of the transistor. The converter obtained high power density (1.4 kW / dm^3) and high efficiency (95.1 %) at maximum output power of 300 W and voltage gain of 7.6.