

論文 / 著書情報  
Article / Book Information

|                   |                                                                                                                                                                                               |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 題目(和文)            |                                                                                                                                                                                               |
| Title(English)    | Study of Power Loss Reduction of an Active Front-end Rectifier Using an Instantaneous Reactive Power Compensator                                                                              |
| 著者(和文)            | スラサ ッ ク ヌイルート                                                                                                                                                                                 |
| Author(English)   | Surasak Nuilers                                                                                                                                                                               |
| 出典(和文)            | 学位:博士(学術),<br>学位授与機関:東京工業大学,<br>報告番号:甲第12296号,<br>授与年月日:2022年12月31日,<br>学位の種別:課程博士,<br>審査員:藤田 英明,千葉 明,萩原 誠,竹内 希,清田 恭平,和田 圭二                                                                   |
| Citation(English) | Degree:Doctor (Academic),<br>Conferring organization: Tokyo Institute of Technology,<br>Report number:甲第12296号,<br>Conferred date:2022/12/31,<br>Degree Type:Course doctor,<br>Examiner:,,,,, |
| 学位種別(和文)          | 博士論文                                                                                                                                                                                          |
| Category(English) | Doctoral Thesis                                                                                                                                                                               |
| 種別(和文)            | 論文要旨                                                                                                                                                                                          |
| Type(English)     | Summary                                                                                                                                                                                       |

## 論文要旨

### THESIS SUMMARY

系・コース：

Department of, Graduate major in

Electrical and  
Electronic  
Engineering

系  
コース

申請学位(専攻分野)： 博士

Academic Degree Requested

Doctor of

(Philosophy)

学生氏名：

Student's Name

Surasak Nuilers

指導教員(主)：

Academic Supervisor(main)

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Academic Supervisor(sub)

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要旨(英文 300 語程度)

Thesis Summary (approx.300 English Words)

This thesis presents an ac/dc power conversion system by using a three-phase diode rectifier with an instantaneous reactive power compensator (IRPC) which has capability to control the grid current sinusoidal. In the conventional circuit, an electrolytic capacitor is used to smooth dc-link voltage. The IRPC cannot completely inject the compensating harmonic currents of the rectifier because a dc-link capacitance causes a low impedance which draws an increased harmonic current into capacitor. As a result, the IRPC requires high current rating and causes high power losses of its switching devices.

In the proposed circuit, the small ac inductor is placed at the ac side of the diode rectifier to increase its impedance, and a small film capacitor is used at the dc-link voltage connecting to a dc/dc converter. When the dc/dc converter controls power to load, the ac current of the diode rectifier is formed as square waveshape that behaves like a harmonic current source. Thus, the IRPC can provide the current around 32% of the grid current rating to suppress the harmonic current of the diode rectifier. This gives an opportunity to reduce a switching and conduction losses of switching devices, and can improve the efficiency and the power density of the system. Moreover, the volume of ac inductor is expected to reduce to  $\frac{1}{4}$  of a conventional PWM rectifier.

This thesis presents a new control technique to control the grid current sinusoidal by estimating the instantaneous active and reactive powers of the diode rectifier having two modes such as two-diode and three-diode connections (commutation overlap). Moreover, the power loss reduction by combining between discontinuous pulse-width modulation and zero-voltage switching techniques is proposed to extend the soft-switching areas of the proposed circuit operation. The 4.5-kW experimental setup is used to verify the THD and efficiency of 2.87% and 98.6%, respectively.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note：Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

注意：論文要旨は、東工大リサーチリポジトリ(T2R2)にてインターネット公表されますので、公表可能な範囲の内容で作成してください。