Predicting SMPS's remaining life using ripple ratio of electrolyte capacitor

Y.G. Yoon
(Certification Management Center)
Korea Testing Certification
yanggi40@ktc.re.kr

U.H Jeong
(Reliability Assessment Center)
Korea Testing Certification
uhjeong@ktc.re.kr

J.P Hyung
(Reliability Assessment Center)
Korea Testing Certification
hjp1974@ktc.re.kr

phmsociety

Fourth European Conference of Prognostics and Health Management Society 3-6 July 2018, Utrecht, The Netherlands

Student Poster

Research Objective

Our objective is predicting electrolyte capacitor's lifetime at operating situation using ripple ratio.

Most electrical products have SMPS(Switched mode power supply) and SMPS's life is mostly dependent on electrolyte capacitor's life. Our research can help predicting SMPS's lifetime and establishing maintenance plan of SMPS.

Expected Contributions

- As electrolyte capacitor degrades ripple increase.
- Electrolyte capacitor is most weak point of SMPS.
- So, Ripple can predict SMPS’s life.
- SMPS is mostly common module in electronic products(charger, motor, PC, etc..)
- So, predicting SMPS’s lifetime and making maintenance plan for SMPS is very important.
- Our research can suggest method that can predict SMPS’s life.

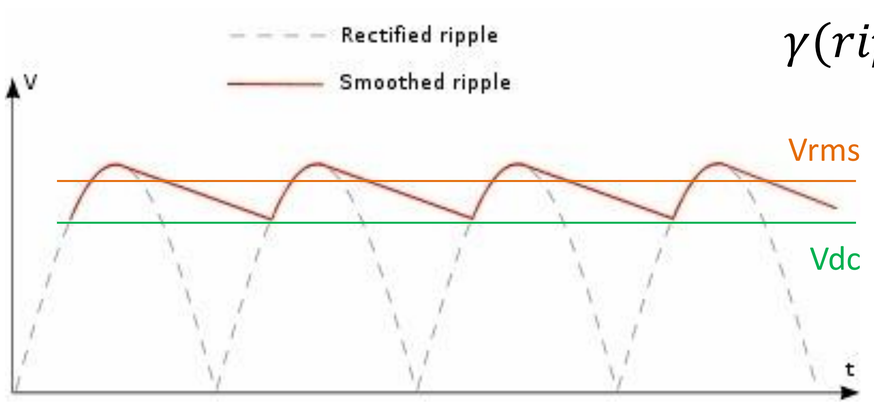
State of Research

- We developed ADT equipment that precisely injects temperature stress to electrolyte capacitor.
- Test designed 2 different condition for ADT test. (260 ℃, 290 ℃)
- Test performed almost 300 hours.
- Result implies ripple increased by degradation of capacitor.

Next Steps

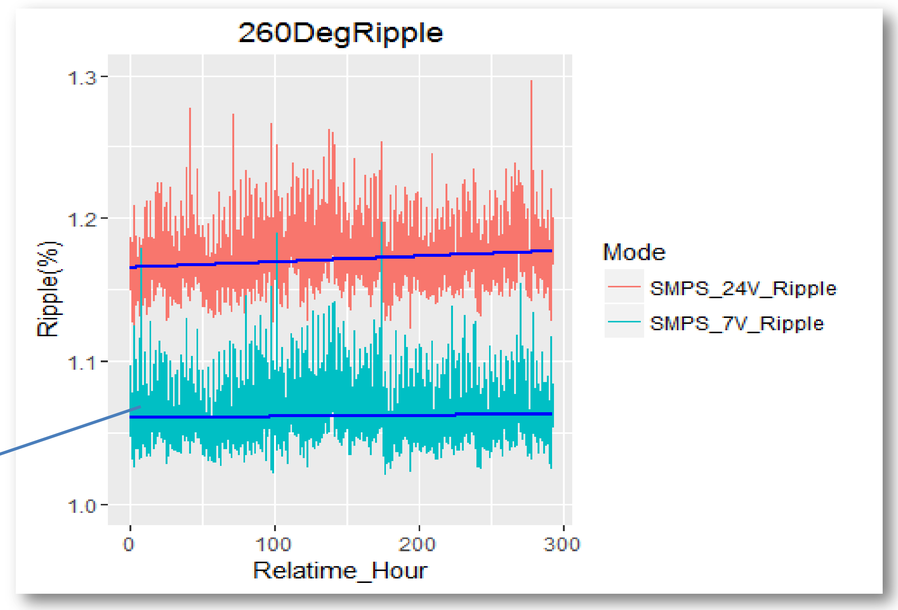
- Find mathmatical relationship between ripple and lifetime.
- How precisely ripple ratio can predict SMPS’s lifetime?
- We find that as capacitor degrades ripple ratio is slightly increases.(Linear Regression) But increase rate is small so it may not sufficient to predict precise failure time.
- Other parts(Switch, MOSFET) can fail faster than electrolyte capacitor.
- Further research we’ll find other factor’s that can predict lifetime of SMPS.

Research Details

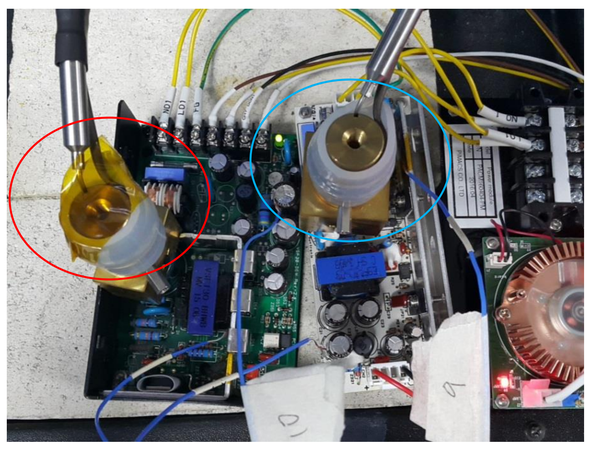


$$\gamma(ripple) = \frac{V_{rms}}{V_{dc}} = \frac{1}{4\sqrt{3}fCR}$$

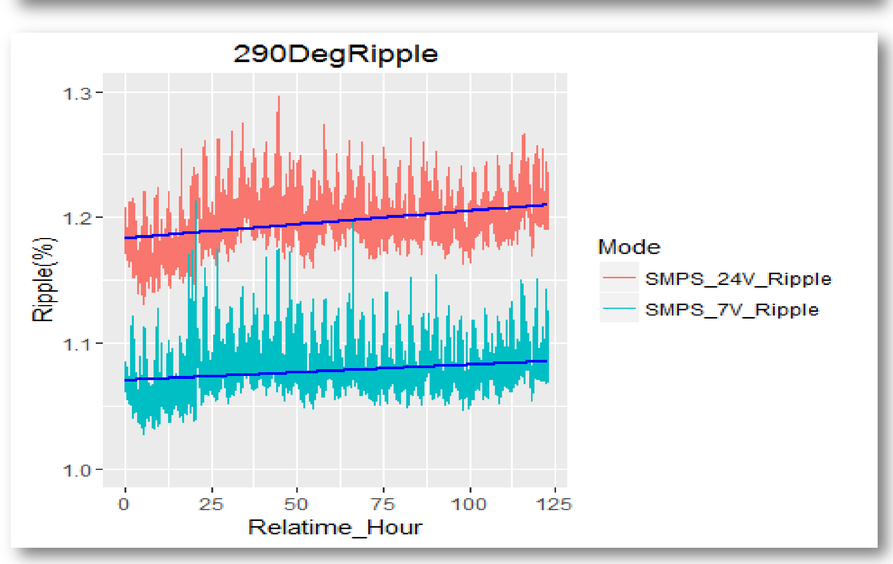
f : Frequency
R : Resistance(Ω)
C : Capacitance(F)



Linear Regression Lines
y=**A***x+b



Spot	Condition	A(slope)
7V	260 ℃	**0.0000834**
	290 ℃	**0.0001235**
24 V	260 ℃	**0.0000391**
	290 ℃	**0.0002163**



Acknowledgments and References

This work (Grants No. 10050980) was supported by New Growth Equipment Reliability Enhancement Project funded by Korea Evaluation Institute of Industrial Technology.

A. Nishino, Capacitors: operating principles, current market and technical trends, J. Power Sources. 60 (1996).