

# **Dedication**

To my parents

To my supportive family

To my beloved country

## **Acknowledgement**

All praise and thanks is due to Almighty God, the creator and sustainer of the worlds. I wish to thank Him for all that He has gifted us with, although, He can never be praised or thanked enough.

My deepest thanks to my supervisor, Ustaz.Abd -Alla Salih Ali, for his patience, support, helpful advices, systematic guidance, and encouragement.

Thanks to all who helped and I forgot to mention them.

## Abstract

In this project, a compensated control system was designed using Bode plot technique.

The system required must have a phase margin about  $45^\circ$  and gain margin about  $35dB$ . The original system when plotted the phase margin is  $0.005^\circ$ . This means that the system need a phase – lead network as a compensator.

The velocity error of the original system is found by using the final value theorem. The maximum phase is obtained from which  $\alpha$  was calculated. From Bode plot  $w_m$  is obtained at gain crossover frequency and from  $w_m$  and  $\alpha$ , the lead network transfer function was obtained.

When the obtained transfer function was cascaded with the original system, the required gain and phase margin were obtained.

## مستخلص

في هذا البحث، تم تصميم نظام تحكم معوض باستخدام مخطط بود. نظام التحكم المطلوب أن يكون له هامش طور حوالي  $45^\circ$  وهامش كسب حوالي  $35dB$ . النظام الأصلي بعد رسم الإستجابة الترددية وجد أن له هامش طور  $0.005^\circ$  ، وبالتالي النظام يحتاج إلي معوض تقديمي.

تم إيجاد ثابت السرعة بإستخدام نظرية القيمة النهائية ثم إيجاد أقصى طور ومن ثم تم حساب  $\alpha$ .

من مخطط بود تم إيجاد  $w_m$  عند عبور مخطط المقدار لخط  $0dB$ . تم إستخدام  $w_m$  و  $\alpha$  لإيجاد ثابت الزمن للمعوض.

عند توصيل المعوض تتابعيا مع النظام وتشغيله تم الحصول علي هامش الكسب والطور المطلوبين لبناء النظام.

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