

Calculation of Mountain Bike Suspension Setup through Mobile Image Analysis

Joe Barrett - 40117680

Submitted in partial fulfilment of the requirements of Edinburgh Napier University for
the Degree of BEng (Hons) Software Engineering

School of Computing

25/09/2016

Abstract

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

Contents

1	Introduction	5
1.1	Context	5
2	Literature Review	7
3	Approach	8
4	Results	9
5	Critical Evaluation	10
6	Conclusion	11
	Acronyms	13
	Glossary	13

List of Tables

List of Figures

1 Introduction

1.1 Context

A survey carried out by the International Mountain Bike Association shows the average price of mountain bikes owned in Europe to be €2546 (£2206) (IMBA Europe, 2015). Starting at around £1000 (Giant Manufacturing Co. Ltd., 2017), enthusiast level mountain bikes can be purchased with suspension for both the front and rear wheels, known as Full Suspension (FS) bikes. Even at this comparably low cost, the suspension units have multiple adjustments available to tune and personalize how they operate.

To ensure the fork and shock function correctly they must be set up for the rider's weight and intended use of the bike. As this is considered a specialist area, many entry and mid level riders will lack the knowledge of this process or be unsure of how the suspension should operate meaning the rider could use the bike without the suspension set up correctly.

It has been proven that using a FS over a Hard Tail (HT) offers a performance advantage to the rider (Titlestad, Fairlie-Clarke, Davie, Whittaker, & Grant, 2003). However if the suspension fork and/or shock have not been set up, it can be detrimental to the rider's performance and potentially lead to injury. For example, if a shock has too little rebound damping set and the rider goes off a jump, the excessive speed at which the rear of the bike extends can create forwards rotation, causing the rider to go over the handlebars of the bike.

Additionally, an incorrect suspension setup can cause excessive wear and tear on the bike's frame and components. Suspension which is set too soft can allow for bottoming out which expends excess forces into the frame and potentially cracks the frame's structure. Suspension set too hard forces energy, which it would normally soak up, into the wheels and tires causing denting and warping of the wheel rims.

Many bicycle retailers will set up the suspension on a newly purchased mountain bike for the customer on delivery. Most of the time this will be enough to avoid incident but due to the extra weight of the equipment riders use, i.e. helmet, hydration pack, body armor which the customer will not be wearing at the time of delivery, this setup is regularly inaccurate. Furthermore, with some manufacturers choosing direct sales over local retailers (Harker, 2010; Staff, 2015), this setup can be circumnavigated altogether.

Since the birth of the modern smartphone in 2007 brought along by the first generation Apple® iPhone® and introduction of the Android™ mobile operating system, the use of mobile computing in everyday life has grown rapidly. Google™ stated that there were approximately 1.4 active Android users worldwide in 2015 (Callaham, 2015).

The introduction of activity tracking devices and mobile applications such as FitBit (Diaz et al., 2015) and Strava (West, 2015) and their growing popularity (Formosa, 2012) shows that individuals are welcome to the idea of using smartphones to aid or augment their participation in hobbies or sports. Due to this popularity and in a bid to give every rider the ability to setup and tune their own suspension, either at home or

while out on a ride, companies have set about producing small devices (Aston, 2016; Hwang, 2016) and mobile applications (Benedict, 2012) which aid riders in the process.

2 Literature Review

3 Approach

4 Results

5 Critical Evaluation

6 Conclusion

References

- Aston, P. (2016). Sussmybike data acquisition - eurobike 2016. Retrieved 24/09/2016, from <http://www.pinkbike.com/news/sussmybike-data-acquisition-eurobike-2016.html>
- Benedict, T. (2012). Fox ird smartphone app sets ups shocks, forks for you. Retrieved 24/09/2016, from <http://www.bikerumor.com/2012/08/29/fox-ird-smartphone-app-sets-ups-shocks-forks-for-you/>
- Giant Manufacturing Co. Ltd. (2017). *Giant stance* [Product Listing]. Retrieved from <https://www.giant-bicycles.com/en-gb/bikes/model/stance/28553/99239/>
- IMBA Europe. (2015). *Imba european mountain bike survey* (Survey). International Mountain Bike Association. Retrieved 24/09/2015, from http://www.imba-europe.com/sites/default/files/IMBA_INFOGRAPHIC_final.pdf
- Callaham, J. (2015). Google says there are now 1.4 billion active android devices worldwide. Retrieved 25/09/2016, from <http://www.androidcentral.com/google-says-there-are-now-14-billion-active-android-devices-worldwide>
- Diaz, K. M., Krupka, D. J., Chang, M. J., Peacock, J., Ma, Y., Goldsmith, J., ... Davidson, K. W. (2015). Fitbit®: An accurate and reliable device for wireless physical activity tracking. *International Journal of Cardiology*, 185, 138-140. Retrieved 24/09/2016, from <http://dx.doi.org.ezproxy.napier.ac.uk/10.1016/j.ijcard.2015.03.038>
- Formosa, N. (2012). Social fitness apps storm cycling world. *Bicycle Retailer and Industry News*, 21, 28-29. Retrieved 24/09/2016, from http://search.proquest.com.ezproxy.napier.ac.uk/docview/1018189163?rfr_id=info%3Axri%2Fsid%3Aprimo
- Harker, J. (2010). German brand rose hopes to bloom in britain. Retrieved 24/09/2016, from <http://www.bikebiz.com/news/read/german-brand-rose-hopes-to-bloom-in-britain/08815>
- Hwang, J. C. B. (2016, 05 19). *Shockwiz* (Trademark Application No. 87042899). 1000 West Fulton Market, 4th Floor, Chicago, Illinois, 60607, USA. Retrieved 25/09/2016, from <https://trademarks.justia.com/870/42/shockwiz-87042899.html>
- Staff, B. (2015). Yt industries launches consumer-direct sales in north america, oceania. Retrieved 24/09/2015, from <http://www.bicycleretailer.com/industry-news/2015/01/30/yt-industries-launches-consumer-direct-sales-north-america-oceania>
- Titlestad, J., Fairlie-Clarke, T., Davie, M., Whittaker, A., & Grant, S. (2003). Experimental evaluation of mountain bike suspension systems. *Acta Polytechnica*, 43, 15-20.
- West, L. R. (2015). Strava: challenge yourself to greater heights in physical activity/cycling and running. *British Journal of Sports Medicine*, 49, 1024. Retrieved 24/09/2016, from <http://bjsm.bmj.com.ezproxy.napier.ac.uk/content/49/15/1024.full>

Acronyms

FS Full Suspension. 5, *Glossary*: full suspension

HT Hard Tail. 5, *Glossary*: hard tail

Glossary

Fork The front suspension unit on a mountain bike. 5

Full Suspension A mountain bike with both front and rear suspension. 5

Hard Tail A mountain bike with only front suspension. 5

Rebound Damping Controls the speed at which a suspension unit extends once it has been compressed. Less damping means the unit extends faster. 5

Shock The rear suspension unit. Only found on full suspension mountain bikes. 5