# MOTORCYCLE HANDLING AND CHASSIS DESIGN

the art and science

## List of Chapters:

1. **Function and history**
   - Some basic definitions
   - Function
   - History
   - Front suspension
   - Rear suspension
   - Spring types
   - Load Compensation

2. **Tyres**
   - Weight support
   - Suspension action
   - Tyre stiffness or spring rate
   - Contact area
   - Area when cornering
   - Friction (grip)
   - Braking & driving
   - Cornering
   - Mechanisms of grip
   - Under- and over-steer
   - Construction
   - Materials
   - Summary

3. **Geometric considerations**
   - Basic motorcycle geometry
   - Trail
   - Rake or castor angle (steering axis inclination)
   - Wheelbase
   - Wheel diameter
   - Other considerations
   - Angular motions

4. **Balance and steering**
   - Balance
   - Steering
   - Gyroscopic effects only
   - Gyroscopic with tyre camber force only
   - Gyroscopic with tyre camber and steer forces
   - Tyre forces only - no gyroscopic effects
   - Body lean only - no steering
   - Conclusions

5. **Aerodynamics**
   - Drag
   - Evolution of the racing fairing
   - Internal air flow
   - Lift
   - Airflow evaluation
   - Side wind stability (traditional view)
   - Steady state directional stability
   - Dynamic directional stability
   - Summary

6. **Suspension principles**
   - Springs
   - Damping
   - Sprung and unsprung mass
   - Basic suspension principles
   - Other factors
   - Lateral suspension
   - Summary

7. **Front suspension**
   - Head stock mounted forks
   - Alternatives to the head stock mounted fork
   - Hub centre steered
   - Double link
   - McPhearson strut based
   - Virtual steering axis

8. **Rear suspension**
   - Effective spring rate
   - Chain effects
   - Wheel trajectory
   - Structural
   - Single or dual sided
   - Summary

9. **Squat and dive**
   - Load transfer
   - Squat and dive
   - Shaft drive
   - Chain drive
   - Aerodynamic squat
   - Braking reaction (rear)
   - Dive (front)
   - Dynamic effects
   - Summary

10. **Structural considerations**
    - Fatigue
    - Structural efficiency
    - Triangulation
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Triangulated frames
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Structural comparison
Fabricated backbone
Monocoque
Structural engine
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Two wheel drive (2WD)
Two wheel steering (2WS)
Feet-Forward motorcycles. (FF)

Appendices
A1 Experiments with rake and trail
Rake
Trail
Conclusions
Post script

A2 Glossary of terms
A3 Units conversion
A4 Gyroscopic effects

A5 Basic physics of motorcycles
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Momentum
Newton’s laws
Force and weight
Moments, couples and torque
Centripetal & centrifugal force
Addition and resolution of velocities and forces
Work, energy and power
Nomenclature and sign conventions
Normalization

A6 Analysis of mechanisms
A7 CoG and mass distribution of rider
A8 Typical data

Notes

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