

MURAT OKÇUOĞLU
AUTOMOTIVE SAFETY RESEARCH

4175 LAGO DRIVE
SANTA BARBARA, CALIFORNIA 93110

TELEPHONE +1-805-637-5482
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Email murat@cox.net

Curriculum Vitae of
Murat Okçuoğlu

Murat Okçuoğlu has over 30 years of active involvement in automotive design, testing and evaluation of drivetrains, suspension systems, brake systems, chassis control systems including electronic stability control systems, vehicle handling and vehicle stability. His automotive career includes engineering, designing and testing components for automotive manufacturers, OEMs, and Tier1 suppliers, integrating vehicles and vehicle systems, test track and road testing of dynamic vehicle behavior, validation of components and systems for OEMs and Tier1 suppliers, designing and preparing racecars, driving racecars. Mr. Okçuoğlu has invented and developed advanced all-wheel drive systems. These systems are currently being used by leading SUV and car manufacturers. During the integration of these systems to individual vehicle platforms, Mr. Okçuoğlu worked intimately with the development team for seamless vehicle dynamics integration. Following an intense 15-year vehicle research and development career and vehicle handling work with almost all US and European automobile manufacturers, Mr. Okçuoğlu began conducting detailed systems analyses of vehicle handling and stability issues that lead to catastrophic injury accidents. In the last 13 years, he has conducted numerous detailed systems analyses of catastrophic injury accidents in accordance with established industry practices and protocols published by SAE. Mr. Okçuoğlu has worked with and participated in dynamic vehicle testing for handling and safety issues with OEM and supplier engineers on many proving grounds and test tracks, testing and evaluating vehicles manufactured by most OEMs. Mr. Okçuoğlu has additional and concurrent 18 years of racing experience with production vehicles including suspension design, stability improvement and handling optimization work.

He has published several research papers and articles on advanced automotive technology, presented his findings in technical conferences and lectures.

CURRENTLY

- Automotive handling and stability research and consulting
- Formulates opinions from available factual data about vehicle trajectories, vehicle characteristics, failure modes and design characteristics
- Scientifically validates, quantifies and illustrates opinions by computer analysis
- Evaluates the potential effects of design alternatives and available technology on accident outcome compared to baseline design
- Conducts research relating to active vehicle safety systems

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EDUCATION

Boğaziçi University (Formerly known as Robert College) BS in Mechanical Engineering

EXPERIENCE SUMMARY

- Independent Consultant, 2000 - Current
Vehicle Dynamics and ESC research
- Friedman Research Corporation, consulting 2000-2009
Director of Engineering for Vehicle Stability
- McLaren Automotive / Asha Corporation 1991-1999
Executive Engineer, 1998-1999
Chief Engineer, 1991-1998
- Motar Automotive Co. 1985-1986
Assistant Technical Manager
- Bosch GmbH 1982-1985
Team Chief & Engineer
- OtoKar Co. Magirus-Deutz 1980-1982
Technical coordinator



Extensive experience in vehicle dynamics and research including:

- Vehicle dynamics, handling analysis, performance and safety evaluation
- Evaluation of driver interface and driver feedback mechanisms for improved vehicle control
- Analysis of surface condition and road condition effects on vehicle dynamics
- Effects of drivetrain configuration on motor vehicle handling and safety
- Brake system performance, effects of brake system on handling and brake system fatigue resistance
- Steering systems, steering response and steering geometry

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- Suspension geometry and design, suspension compliance and effects of thereof on vehicle handling
- Shock absorbers, damping characteristics and effects on handling
- Spring rates, optimizing spring rates for improvement of vehicle handling
- Driver ergonomics and optimization of vehicle controls for driving tasks
- Tire selection, tire performance validation, tire failures and tire durability
- Effects of traction control systems on vehicle dynamics at high speeds
- Active electronic stability control systems
- Utilization of Active Torque Transfer Systems for improvement of vehicle control including vectoring
- Suspension systems and optimization of suspension tuning for improved handling and safety
- Systems level approach to vehicle handling through system integration
- Performed dynamic vehicle testing and evaluation in many facilities worldwide, including:
 - AM General test track, South Bend, Indiana
 - Dana Corporation test track, Indiana
 - Chrysler test track, Chelsea, Michigan
 - General Motors test track, Milford, Michigan
 - Ford Motor Company test track, Dearborn, Michigan
 - Porsche AG test track, Weißach, Germany
 - Audi AG test track, Neustadt, Germany
 - Nürnbergring, Germany
 - Smithers Winter Test Center, Racó Michigan
 - Steyr Daimler Puch Fahrzeugtechnik test track, Graz, Austria
 - Arvidsjaur, Sweden
 - Arjeplog Test Center, Lapland, Sweden
 - Skellefteå, Sweden
 - Arctic Circles test track, Sault Ste. Marie, Michigan
 - Land Rover test track, Eastnor Castle, Birmingham, England
 - Bosch Proving Ground, Boxberg, Germany
 - Rovaniemi, Finland

Worked with all Detroit OEMs and most European OEMs and Tier1 suppliers, including

- | | |
|------------------|----------------------|
| • General Motors | • Saturn |
| • Cadillac | • Ford Motor Company |
| • Pontiac | • DaimlerChrysler |
| • Buick | • Jeep |
| • Chevrolet | • Visteon |
| • GMC | • Delphi |

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- Dana
- Rockwell (Meritor)
- NVG, New Venture Gear
- AAM, American Axle Manufacturing Co.
- Porsche
- Audi
- BMW
- ZF
- Peugeot
- Renault
- Fiat
- Saab
- Steyr Daimler Puch
- Bugatti

Designed following systems

- Suspension systems
- Brake systems
- Electrical systems
- Transmission systems
- All wheel drive systems
- Differential systems
- Traction control systems
- Emergency brake systems
- Front axles
- Rear axles
- Transaxles
- Transfer cases
- Exhaust systems
- Intake and air induction systems
- Forced induction systems
- Water injection systems
- Cooling systems
- Seating systems
- Instrument panels
- Safety systems
- Fire extinguishing systems
- Safety harness systems
- Fuel systems

Designed following components

- Shock absorbers
- Differentials
- Couplings
- A-arms
- Fasteners
- Axle shafts
- Exhaust manifolds and headers
- Inlet manifolds
- Air cleaner enclosures
- Seats

Worked on the design of following systems and components

- Suspension systems
- Brake systems
- Electronic stability control systems
- Transmission systems
- All wheel drive systems
- Differential systems
- Traction control systems
- Front axles
- Rear axles
- Differentials

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- Axle shafts
- Couplings
- Transaxles
- Transfer cases

MEMBERSHIPS

- Society of Automotive Engineers
- American Society of Mechanical Engineers
- International Council of Motorsport Sciences

SOME OF THE PUBLICATIONS AND PRESENTATIONS

- SAE 952642 “*A Descriptive Analysis of Gerodisc Type Limited Slip Differential and All Wheel Drive Couplings*” Presented at Society of Automotive Engineers, Bus and Truck Congress, North Carolina, 1995
- SAE 962541 “*Adjustable Racing Limited Slip Differentials Utilizing Gerodisc System*” Presented at Society of Automotive Engineers, Motorsports Congress, Detroit, 1996
- SAE 973235 “*All Wheel Drive Systems Utilizing Twin Hydraulic Couplings With Gerodisc System*” Presented at Society of Automotive Engineers, Bus and Truck Congress, 1997
- SAE “*Rationalized 4x4 Systems for the 21st Century*” Presented at the Innovations in All Wheel Drive / Four Wheel Drive Systems TOPTEC, Society of Automotive engineers, South Bend, Indiana, 1999
- EuroForum “*Platform Consolidation in the Automotive Industry*” London, England, 1999
- SAE 2000-01-3460 “*Influencing Dynamic Handling Response Through Manipulation of Advanced All Wheel Drive Systems*” Presented at Society of Automotive engineers, Truck & Bus Meeting & Exposition, Portland, Oregon 2000
- Safety Forum, “*Vehicle Design and Driving Safety*” Presented at Istanbul Technical University, 2006
- ICrash2006, “*Consideration of Vehicle Handling and Stability with Improved Roof Strength*” M Okcuoglu, K Friedman, D Mihora, and J Hutchinson, J Wiedmann, S Reid, and S Chan, International Crashworthiness Conference, Athens, Greece, 2006

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- Invited Lecture, “*Vehicle Dynamics and Safety*”, Automotive Technology Research and Development Center, Istanbul Technical University, 2006
- Vehicle Dynamics Expo, “*Explaining the mechanism of contribution of under steer reduction function of Electronic Stability Control Systems in overall accident prevention effectiveness of Electronic Stability Control Systems*” Detroit, Michigan 2007
- Technology Forum, Vehicle Dynamics Expo “*Establishing Adaptive Engagement Criteria for Electronic Stability Control Systems*” Novi, Michigan 2008
- Invited Lecture, “*Practical Aspects of Vehicle Dynamics*”, Department of Mechanical Engineering, University of California, Santa Barbara, 2010
- Open Technology Forum, Traction, Stability and Braking, Vehicle Dynamics Expo “*Retrofit of electronic stability control systems, analysis of possibilities and benefits*” Stuttgart, Germany 2010
- Invited Lectures, “*Various topics Automotive Engineering*”, Department of Mechanical Engineering, University of California, Santa Barbara, UCSB 2011
- Invited Lecture, “*Automotive Design*”, Boğaziçi University, 2012
- Invited Presentation, “*Automotive Engineering*”, American Society of Mechanical Engineers (ASME) Section, University of California, Santa Barbara, UCSB 2012
- Invited Lectures, “*Automotive Engineering*” ASME & ME11, University of California, Santa Barbara, UCSB 2014
- Technical Workshop, Professional Motorsport World Expo, “*Electronic Stability Control and Driving Aids in Amateur Racing*” Cologne, Germany, 2014

SOME OF THE PATENTS AND INVENTIONS

- US patent 5,310,388 Vehicle drivetrain hydraulic coupling
- US patent 5,536,215 Hydraulic coupling for vehicle drivetrain
- US patent 5,595,214 Hydraulic coupling for vehicle drivetrain
- US patent 5,735,764 Hydraulic coupling for vehicle drivetrain
- US patent 5,827,145 Hydraulic coupling having supplemental actuation
- US patent 5,888,163 Hydraulic coupling for vehicle drivetrain
- US patent 5,941,788 Vehicle drivetrain differential
- US patent 5,964,126 Hydraulic coupling for auxiliary drive axle of a vehicle drivetrain

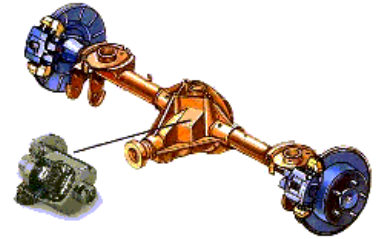


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- US patent 6,176,800 Hydraulic coupling for vehicle drivetrain
- European patent 0 682 754 B1 Vehicle drivetrain hydraulic coupling
- European patent 0 886 083 A3 Hydraulic coupling for vehicle drivetrain
- European patent 0 886 083 A2 Hydraulic coupling for vehicle drivetrain
- European patent 0 830 528 A1 Hydraulic coupling for vehicle drivetrain
- European patent 0 682 754 A1 Hydraulic coupling for vehicle drivetrain
- European patent EP 0 886 083 B1 Differentiel à glissement limité
- European patent 0 682 754 A4 Couplage hydraulique de transmission de vehicule
- Japanese patent JP 2002 523 30 2T
- Australian patent AU 5702399A
- Japanese patent JP H09 501 21 9A
- Austrian patent AT 221632T Differential mit begrenztem schlupf
- Austrian patent AT 180047T Fahrzeugantrieb mit hydraulischer kupplung
- Chinese patent CN 1109423A Vehicle drivertrain hydraulic coupling
- Australian patent AU 7171396A Vehicle drivetrain hydraulic coupling
- Australian patent AU 727417B2 Hydraulic coupling having supplemental actuation
- Australian patent AU 681329B2 Vehicle drivetrain hydraulic coupling
- Australian patent AU 6155598A
- Brazilian patent BR 9808025A Acoplamento Hidráulico Tendo Atuação Suplementar
- Australian patent AU 3916393A Vehicle drivetrain hydraulic coupling
- Australian patent AU 672602B2
- German patent DE 69332179T2 Differential mit begrenztem schlupf
- German patent DE 69324931T2 Fahrzeugantrieb mit hydraulischer kupplung
- Spanish patent ES 2131 111 T3 Acoplamiento hidraulico para transmision de vehiculo
- Korean patent KR 10-019 611 4B1 Vehicle drive train hydraulic coupling
- International patent WO 984 178 3A1 Hydraulic coupling having supplemental actuation
- European patent 0 966 626 A1
- Japanese patent JP 2001 521 60 5A
- European patent 0 830 528 A4 Hydraulic coupling for vehicle drivetrain
- Japanese patent JP H11 506 81 8A
- Mexican patent MX PA 01 0023 11A
- Japanese patent JP 2002 523 30 2A
- European patent EP 1 108 159 A1
- Canadian patent CA 234 222 6A1
- Australian patent AU 5883596A
- International patent WO 199 604 109 0A1
- International patent WO 001 291 5A1
- International patent WO 964 109 0A1

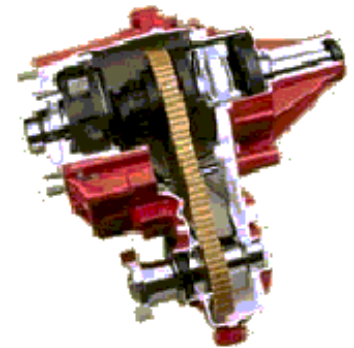
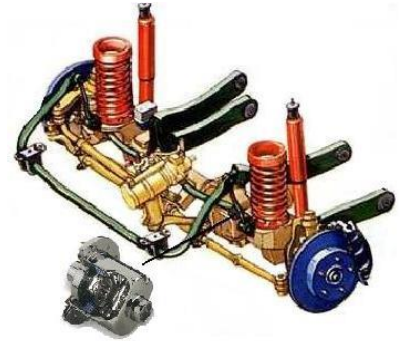


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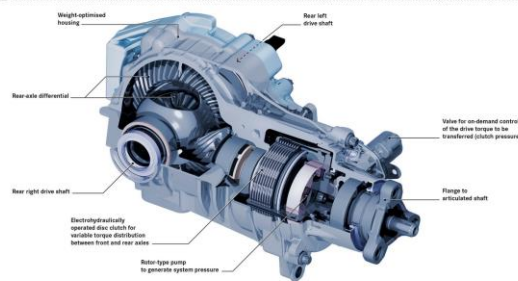
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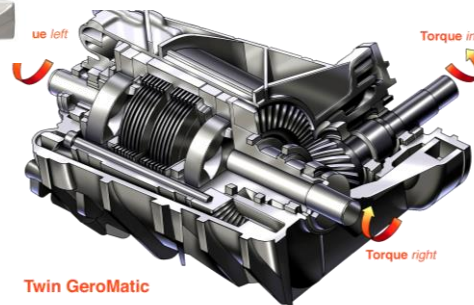
- 1999 Jeep Grand Cherokee All Wheel drive system
- 1999 Jeep Grand Cherokee transfer case coupling
- 1999 Jeep Grand Cherokee front axle limited slip differential
- 1999 Jeep Grand Cherokee rear axle limited slip differential
- 2000 Ford Mustang Cobra R rear axle limited slip differential
- 2001 Pontiac Aztek All Wheel Drive system
- 2001 Pontiac Aztek rear third member
- 2002 Buick Rendezvous All Wheel Drive system
- 2002 Buick Rendezvous rear third member
- 2002 Chevrolet Venture All Wheel Drive system
- 2002 Chevrolet Venture rear third member
- 2002 Pontiac Montana All Wheel Drive system
- 2002 Pontiac Montana rear third member
- 2002 Oldsmobile Silhouette All Wheel Drive system
- 2002 Oldsmobile Silhouette rear third member
- 2003 Saturn Vue All Wheel Drive System
- 2003 Dodge Viper SRT-10 Limited Slip rear Differential
- 2005 Chevrolet Equinox, self-activating All Wheel Drive System
- 2005 Buick Terraza All Wheel Drive System
- 2006 Chevrolet Uplander All Wheel Drive System
- 2006 Pontiac Torrent All Wheel Drive System
- 2014 Mercedes CLA 4matic All Wheel Drive System
- HydraLok system
- VariLok differentials
- Gerodisc differentials
- TwinDisc systems
- GeroMatic system
- VersaTrak system



▲ The new 4MATIC from Mercedes-Benz in detail: torque-on-demand rear-axle transmission with integrated electrohydraulic disc clutch



Mercedes-Benz



Twin GeroMatic



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SOME OF THE VEHICLES UTILIZING THE INVENTIONS

Jeep Grand Cherokee

Front and rear limited slip differential systems (HydraLok differentials in VariLok progressive axles, 1999 and later models Jeep Grand Cherokee) Licensed to and manufactured by Dana Corporation

Transfer case coupling (Quadra Trac II Transfer Case, 1999 and later models Jeep Grand Cherokee) Licensed to and manufactured by New Venture Gear

All Wheel Drive system, integrating above inventions (Quadra-Drive system and Vari-Lok axles, 1999 and later models Jeep Grand Cherokee)



Ford Mustang Cobra R

Gerodisc self contained speed and torque sensitive rear axle limited slip differential, introduced in model year 2000



Pontiac Aztek

TwinDisc All Wheel Drive system (GeroMatic, VersaTrak) Licensed to and manufactured by Steyr Daimler Puch, currently a division of Magna, introduced in model year 2001



Buick Rendezvous

TwinDisc All Wheel Drive system (GeroMatic, VersaTrak) Licensed to and manufactured by Steyr Daimler Puch, currently a division of Magna, introduced in model year 2002



Chevrolet Venture

TwinDisc All Wheel Drive system (GeroMatic, VersaTrak) Licensed to and manufactured by Steyr Daimler Puch, currently a division of Magna, introduced in model year 2002



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Oldsmobile Silhouette

TwinDisc All Wheel Drive system (GeroMatic, VersaTrak) Licensed to and manufactured by Steyr Daimler Puch, currently a division of Magna, introduced in model year 2003



Pontiac Montana

TwinDisc All Wheel Drive systems (GeroMatic, VersaTrak) Licensed to and manufactured by Steyr Daimler Puch, currently a division of Magna, introduced in model year 2002, Montana was available with StabiliTrak (ESC)



Saturn Vue

All Wheel Drive System. Licensed to and manufactured by New Venture Gear, integrated by Visteon, introduced in model year 2002



Dodge Viper SRT-10

HyroLok self contained rear axle limited slip differential. Licensed to and manufactured by Dana Corporation, introduced in model year 2003



2005 Chevrolet Equinox

All Wheel Drive System. Licensed to and manufactured by New Venture Gear, integrated by Visteon, introduced in model year 2005



2005 Chevrolet Uplander

TwinDisc All Wheel Drive systems (GeroMatic, VersaTrak) Licensed to and manufactured by Steyr Daimler Puch, currently a division of Magna, introduced in model year 2005, available with StabiliTrak (ESC)



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2005 Buick Terraza

TwinDisc All Wheel Drive systems (GeroMatic, VersaTrak) Licensed to and manufactured by Steyr Daimler Puch, currently a division of Magna, introduced in model year 2002, available with StabiliTrak (ESC)



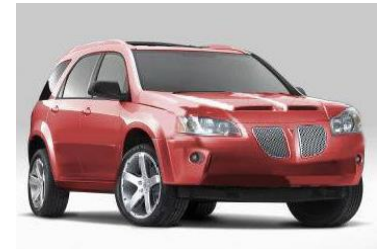
COMBATT Military Truck

Front and rear limited slip differential systems (HydraLok differentials in VariLok progressive axles, Truck by Dodge, axles licensed to and manufactured by Dana Corporation



2006 Pontiac Torrent

TwinDisc All Wheel Drive systems (GeroMatic, VersaTrak) Licensed to and manufactured by Steyr Daimler Puch, currently a division of Magna, introduced in model year 2002



2005 Saturn Relay

TwinDisc All Wheel Drive systems (GeroMatic, VersaTrak) Licensed to and manufactured by Steyr Daimler Puch, currently a division of Magna, introduced in model year 2002, available with StabiliTrak (ESC)



2001 GMC TerraCross Concept Vehicle

All Wheel Drive (VersaTrak) system



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Jeep Compass Concept Vehicle

All Wheel Drive (Quadra-Drive) system with front and rear limited slip differential systems



Buick Centieme Concept Vehicle

All Wheel Drive (VersaTrak) system



2014 Mercedes CLA 4matic

Torque On Demand rear axle transmission

