Swerve Drive Configuration Study Rev B

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How to read this document:

1 Steering & power configurations are tabulated for each manuver
2 Steering configurations are shown in columns, power configurations are shown in rows
3 Similar colors indicate that either the steering or power systems of two or more of the swerve pods are coupled together
4 Inversely-coupled connections (e.g. the chains are crossed) are highlighted in red
5 In some cases, example wheel directions are indicated by "\" or "/"
6 In some cases, example chain paths are indicated by thick borders

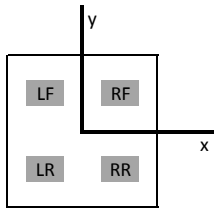
References

[1] http://www.chiefdelphi.com/media/papers/2426
[2] http://www.chiefdelphi.com/forums/showpost.php?p=1185372&postcount=21
[3] http://www.chiefdelphi.com/forums/showpost.php?p=1043263&postcount=24
[4] http://www.chiefdelphi.com/forums/showpost.php?p=992407&postcount=9

Assumptions

A Robot chassis consists of 4 swerve pods arranged in a rectangle
B Swerve pods use a traction-type wheel
C Swerve pods can rotate into any position; rotation occurrs instantaneously

Chassis configuration and axes orientation:



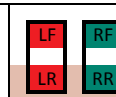
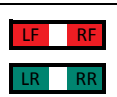
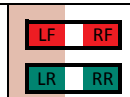
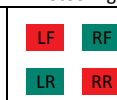
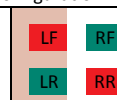
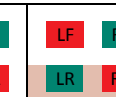
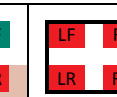
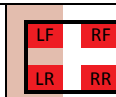
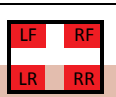
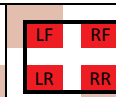
Reductions due to symmetry

Steering configuration

Power configuration	A	B	B'	B	B'	C	C'	C'	D	D'	D'	D'
1	{1}	{4}	{8}	Functionally same as {4}	Functionally same as {8}	{12}	{15}	Functionally same as {15}	{18}	{21}	Functionally same as {21}	{25}
2	{2}	{5}	{9}	Functionally same as {6}	Functionally same as {10}	{13}	{16}	Functionally same as {16}	{19}	{22}	Functionally same as {23}	{26}
2	Functionally same as {2}	{6}	{10}	Functionally same as {5}	Functionally same as {9}	Functionally same as {13}	Functionally same as {16}	Functionally same as {16}	Functionally same as {19}	{23}	Functionally same as {22}	Functionally same as {26}
3	{3}	{7}	{11}	Functionally same as {7}	Functionally same as {11}	{14}	{17}	Functionally same as {17}	{20}	{24}	Functionally same as {24}	{27}

Common names

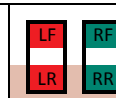
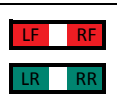
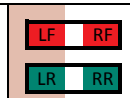
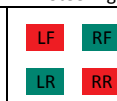
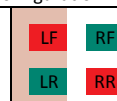
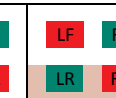
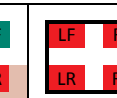
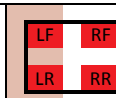
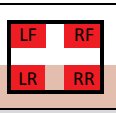
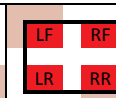
Steering configuration

Power configuration														
	Independent, unicorn*, king crab									Crab drive			
										Crab drive			
		973's King Krab											
										Crab drive			

*The name "unicorn drive" implies a 4-wheel independent-steering and independent-driven drivetrain, with unlimited rotation of the wheels and sensors, and no gaps in the sensor feedback, per [4].

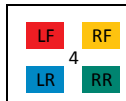
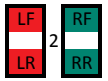
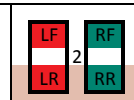
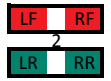
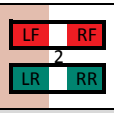
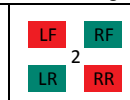
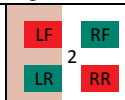
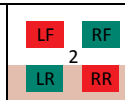
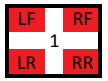
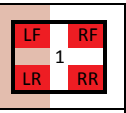
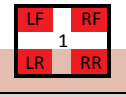
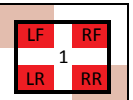
Notable examples

Steering configuration

Power configuration														
	1717 in 2012, 1640 in 2010-2013	79 in 2011, 234 in 2010								180 in 2010			1565 in 2008
	1625 in 2008	1717 in 2009				1717 in 2010 & 2011				1625 in 2010			
		973 in 2008											
		2022 in 2009, 118 in 2007, 1075 in 2006								118 and 148 in 2008			

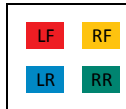
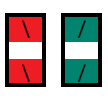
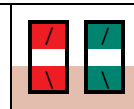
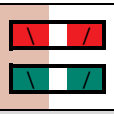
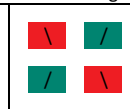
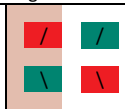
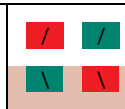
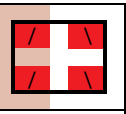
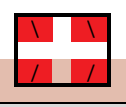
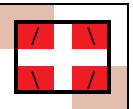
Number of motors

Steering configuration

Power configuration												
	8	6	6			6	6		5	5		5
	6	4	4			4	4		3	3		3
		4	4							3		
	5	3	3			3	3		2	2		2

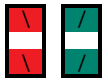
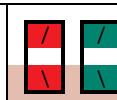
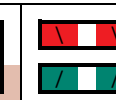
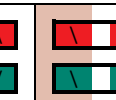
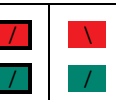
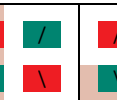
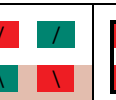
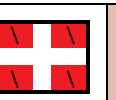
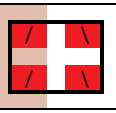
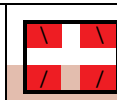
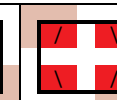
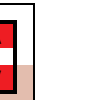
"Dosado" maneuver naming credit: Ether [1]

Steering configuration

Power configuration												
	Y	Steering slip	N			Steering slip	N		Steering slip	N		N
	Wheelspeed slip	Wheelspeed & steering slip	N			Wheelspeed & steering slip	N		Wheelspeed & steering slip	N		N
		Wheelspeed & steering slip	N							N		
	Wheelspeed slip	Wheelspeed & steering slip	N			Wheelspeed & steering slip	N		Wheelspeed & steering slip	N		N

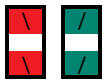
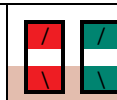
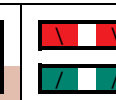
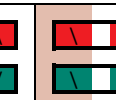
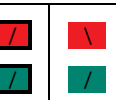
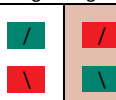
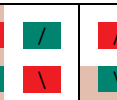
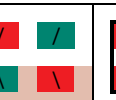
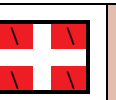
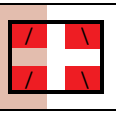
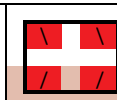
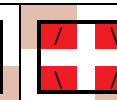
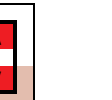
Ackerman steer while translating "forward" (same as "Rotary" and "Moon" [1])

Steering configuration

Power configuration	LF RF / LR RR													
	Y	Steering slip	Y			N	Steering slip		N	Steering slip		N
	Y about point on normal axis; wheelspeed slip otherwise	Wheelspeed & steering slip	Y			N	Steering slip		N	Wheelspeed & steering slip		N
		Steering slip	Wheelspeed slip							Steering slip		
	Wheelspeed slip	Wheelspeed & steering slip	Wheelspeed slip			N	Wheelspeed & steering slip		N	Wheelspeed & steering slip		N

Ackerman steer while translating on arbitrary axis

Steering configuration

Power configuration	LF RF / LR RR													
	Y	N	N			N	N		N	N		N
	Wheelspeed slip	N	N			N	N		N	N		N
		N	N							N		
	Wheelspeed slip	N	N			N	N		N	N		N

Zero-radius turn
or "turn in place"

Power configuration \ Steering configuration	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR
LF RF / LR RR	Y	N	Y			Y	N		N	N		Y
LF RF / LR RR	Y	N	Y			Y	N		N	N		Y
LF RF / LR RR		N	Y							N		
LF RF / LR RR	Y	N	Y			Y	N		N	N		Y

Strafe
on arbitrary axis

Power configuration \ Steering configuration	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR	LF RF / LR RR
LF RF / LR RR	Y	Y	Y for paths along x- and y-axes; N otherwise			Y	Y for paths along x- and y-axes; N otherwise		Y	Y for paths along x- and y-axes; N otherwise		Y for paths along x- and y-axes; N otherwise
LF RF / LR RR	Y	Y	Y for paths along x- and y-axes; N otherwise			Y	Y for paths along x- and y-axes; N otherwise		Y	Y for paths along x- and y-axes; N otherwise		Y for paths along x- and y-axes; N otherwise
LF RF / LR RR		Y	Y for paths along x- and y-axes; N otherwise							Y for paths along x- and y-axes; N otherwise		
LF RF / LR RR	Y	Y	Y for paths along x- and y-axes; N otherwise			Y	Y for paths along x- and y-axes; N otherwise		Y	Y for paths along x- and y-axes; N otherwise		Y for paths along x- and y-axes; N otherwise